HRS DOCUMENTATION RECORD--REVIEW COVER SHEET

Name of Site: ACM Smelter and Refinery
EPA ID No.: MTD093291599

Contact Persons

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Pathways, Components, or Threats Not Scored

Ground Water Migration Pathway

Based on lack of analytical data supporting a release to the aquifers and on the fact that the ground water is not used as a drinking water source, the ground water pathway will not be scored as part of this Hazard Ranking System (HRS) package.

Air Migration Pathway

Documentation of investigations from over 100 years ago conducted by the Boston and Montana Consolidated Copper and Silver Mining Company (Boston & Montana) and later by Anaconda Copper Mining Company (ACM) indicates that the operators of the smelter and refinery were aware that a significant amount of contamination was being emitted by the stack. Topsoil samples were collected and analyzed by the Boston & Montana laboratory in 1904 and 1905. Company chemists concluded that over 40 pounds of arsenic trioxide (As_2O_3) had been deposited per acre up to a distance of 6.24 miles to the northeast of the stack (Ref.32, p. 2). Samples collected from different locations in 1905 confirmed the aerial deposition of contaminates from the stack (Ref. 47, p. 2). Internal ACM company correspondence from November 1951 indicated that the amount of arsenic leaving the stack per twenty-four hours in the early 1950s was approximately 15.04 pounds (Ref. 33).

The EPA chooses not to score the Air Migration Pathway at this time; however the EPA is interested in this potential pathway and may choose to pursue it further at a later date.

HRS DOCUMENTATION RECORD

Name of Site: ACM Smelter and Refinery

Date Prepared: March 2010

EPA Region: Region 8

Street Address of Site: River Road North, 1 mile East of 15th Street

City, County, State: Black Eagle, Cascade County, Montana 59414

*General Location in the State: The ACM Smelter and Refinery and the community of Black Eagle are located on the north bank of the Missouri River, north of Great Falls, Montana (Ref. 3; Ref. 4).

Topographic Map: Northwest Great Falls, Montana 1994 and Northeast Great Falls, Montana

Latitude: 47°31' 42.97" North Longitude: 111° 14' 47.28" West (Ref. 3; Ref. 4)

The location of the reference point at the East Ditch Dump near the south boundary of the former smelter facility close to the Missouri River.

Scores

Ground Water Pathway	0.00
Surface Water Pathway	100.00
Soil Exposure Pathway	78.30
Air Pathway	0.00
HRS SITE SCORE	63.50

*The street address, coordinates, and contaminant locations presented in this HRS documentation record identify the general area the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, placed or otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under CERCLA. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

WORKSHEET FOR COMPUTING HRS SITE SCORE

		S	S^2
1.	Ground water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	NS	NS
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	100	
2b.	Ground water to Surface Water Migration Component (from Table 4-25, line 28)	NS	
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	100	10,000.00
3.	Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	78.30	6,130.89
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	NS	NS
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$		16,130.89
6.	**HRS Site Score** Divide the value on line 5 by 4 and take the square root		63.50

NS = Not Scored

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE SHEET

Factor Categories and Factors	Maximum Value	Value Assigned
Drinking Water Threat		
Likelihood of Release:		
1. Observed Release	550	550
2. Potential to Release by Overland Flow:		
2a. Containment	10	NS
2b. Runoff	25	NS
2c. Distance to Surface Water	25	NS
2d. Potential to Release by Overland Flow (lines 2a[2b+2c])	500	NS
3. Potential to Release by Flood:		
3a. Containment (Flood)	10	NS
3b. Flood Frequency	50	NS
3c. Potential to Release by Flood (lines 3a×b)	500	NS
4. Potential to Release (lines 2d+3c, subject to a maximum of 500)	500	NS
5. Likelihood of Release (higher of lines 1 and 4)	550	550
Waste Characteristics:		
6. Toxicity/Persistence	(a)	NS
7. Hazardous Waste Quantity	(a)	NS
8. Waste Characteristics	100	NS
Targets:		
9. Nearest Intake	50	NS
10. Population		
10a. Level I Concentrations	(b)	NS
10b. Level II Concentrations	(b)	NS
10c. Potential Contamination	(b)	NS
10d. Population (lines 10a+10b+10c)	(b)	NS
11. Resources	5	NS
12. Targets (lines 9+10d+11)	(b)	NS
Drinking Water Threat Score:		
13. Drinking Water Threat Score ([lines 5×8×12]/82,500, subject to a maximum of 100)	100	NS
Human Food Chain Threat		
Likelihood of Release:		
14. Likelihood of Release (same value as line 5)	550	550
Waste Characteristics:		
15. Toxicity/Persistence/Bioaccumulation	(a)	500,000,000
16. Hazardous Waste Quantity	(a)	100
17. Waste Characteristics	1,000	320

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE SHEET

Factor Categories and Factors	Maximum Value	Value Assigned
Targets:		
18. Food Chain Individual	50	45
19. Population		0
19a. Level I Concentrations	(b)	
19b. Level II Concentrations	(b)	0.03
19c. Potential Human Food Chain Contamination	(b)	0.000003
19d. Population (lines 19a+19b+19c)	(b)	0.030003
20. Targets (lines 18+19d)	(b)	45.030003
Human Food Chain Threat Score:		
21. Human Food Chain Threat Score ([lines 14×17×20]/82,500, subject to a maximum of 100)	100	96.06
Environmental Threat		
Likelihood of Release:		
22. Likelihood of Release (same value as line 5)	550	550
Waste Characteristics:		
23. Ecosystem Toxicity/Persistence/Bioaccumulation	(a)	500,000,000
24. Hazardous Waste Quantity	(a)	100
25. Waste Characteristics	1,000	320
Targets:		
26. Sensitive Environments		
26a. Level I Concentrations	(b)	0
26b. Level II Concentrations	(b)	25
26c. Potential Contamination	(b)	0
26d. Sensitive Environments (lines 26a+26b+26c)	(b)	25
27. Targets (value from line 26d)	(b)	25
Environmental Threat Score:		
28. Environmental Threat Score ([lines 22×25×27]/82,500, subject to a maximum of 60)	60	53.33
Surface Water Overland/Flood Migration Component Score for a Watershed		
29. Watershed Score (lines 13+21+28, subject to a maximum of 100)	100	100
Surface Water Overland/Flood Migration Component Score		
30. Component Score $(S_{of})^c$ (highest score from line 29 for all watersheds evaluated, subject to a maximum of 100)	100	100

NS = Not Scored.
(a) = Maximum value applies to waste characteristics category
(b) = Maximum value not applicable
(c) = Do not round to the nearest integer

TABLE 5-1
SOIL EXPOSURE PATHWAY SCORE SHEET

	Factor Categories and Factors	Maximum Value	Value Assigned
RESIDENT POPULATION THREAT			
	Likelihood of Exposure		
1.	Likelihood of Exposure	550	550
	Waste Characteristics		
2.	Toxicity	(a)	10,000
3.	Hazardous Waste Quantity	(a)	10
4.	Waste Characteristics	100	18
	Targets		
5.	Resident Individual	50	50
6.	Resident Population		
	6a. Level I Concentrations	(b)	192.8
	6b. Level II Concentrations	(b)	409.7
	6c. Resident Population (lines 6a + 6b)	(b)	602.5
7.	Workers	15	0
8.	Resources	5	0
9.	Terrestrial Sensitive Environments	(c)	0
10.	Targets (lines 5 + 6c + 7 + 8 + 9)	(b)	652.5
	Resident Population Threat Score		
11.	Resident Population Threat (lines 1 x 4 x 10)	(b)	6,459,750

TABLE 5-1
SOIL EXPOSURE PATHWAY SCORE SHEET

	Factor Categories and Factors	Maximum Value	Value Assigned
NEARBY POPULATION THREAT			
	Likelihood of Exposure		
12.	Attractiveness/Accessibility	100	NS
13.	Area of Contamination	100	NS
14.	Likelihood of Exposure	500	NS
	Waste Characteristics		
15.	Toxicity	(a)	NS
16.	Hazardous Waste Quantity	(a)	NS
17.	Waste Characteristics	100	NS
	Targets		
18.	Nearby Individual	1	NS
19.	Population Within 1 Mile	(b)	NS
20.	Targets (lines 18 + 19)		
	Nearby Population Threat Score		
21.	Nearby Population Threat (lines 14 x 17 x 20)	(b)	NS
SOIL EXPOSURE PATHWAY SCORE			
	Soil Exposure Pathway Score[d]		
22.	(S_s), (lines [11 + 21] ÷ 82,500 subject to a maximum of 100)		78.3

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SITE HISTORY and DESCRIPTION

The ACM Smelter and Refinery site is located in Black Eagle, Montana, near the city of Great Falls (Ref. 3; Ref. 4). As will be described below and in the following pages, the site consists of sources and releases related from the Anaconda Copper Mining Company (ACM) smelter and refining operations (also known as the Anaconda Minerals Co. (AMC), Great Falls Refinery facility). Releases from these operations affect the residential community of Black Eagle and the fisheries and sensitive environments associated with the Missouri River as will be described in this HRS documentation record.

Great Falls, Montana was founded by Minneapolis entrepreneur, Paris Gibson, in 1883 with the vision of a metropolis based upon the waterpower of the Missouri River (Ref. 6, p. 40). In 1889 the Boston and Montana Consolidated Copper and Silver Mining Company (Boston & Montana), headquartered in nearby Butte, Montana, decided to build a new smelter on the north bank of the Missouri River at Great Falls, Montana. The new smelter would use nearby coal deposits for smelting and the hydro power of the Missouri River to mechanically treat ore, to sluice away byproducts, and to generate electricity for electrolytic refining. The new Boston & Montana Refinery opened in 1893 and soon employed 1,200 men (Ref. 6, p. 41). Most of the ore processed at the new smelter came from the mines in Butte, Montana (Ref. 7, p. 5A; Ref. 6 p. 41).

The consolidation of the five major Montana copper operations under the Anaconda Copper Mining Company in 1910 resulted in the Great Falls operation specializing in the refining process and as a result in 1916 new electrolytic copper and zinc operations were built at the Anaconda Minerals Co, Great Falls Refinery facility (Ref. 9, p. 20). A new mill was constructed on the site in 1918 to produce copper wire, rod, and cable (Ref. 7, p. 5A). By mid-century the ACM facility had taken on the appearance that is depicted in the annotated photograph published in the Great Falls Tribune's story "The Rise and Fall of the world's tallest smokestack" (Ref. 8, p. 6A).

The smoke stack at the original 1893 plant was 186 feet tall (Ref. 8, p. 6A). The Big Stack was constructed in 1908 to a length of 506 feet and a total height of 751 feet above the smelter's blast furnace (Ref. 8 p. 7A). The Big Stack went into service on June 12, 1909 and continued belching smoke until August 06, 1972 (Ref. 9, p. 15). The Big Stack was designed to eject a volume of 1,575,000 cubic feet of air per minute at a velocity of 450 feet per minute, a sufficient volume and rate to entrain and remove from the smelter all the gases and dust generated during the smelting process (Ref. 9, p. 20).

The wind in the Great Falls Montana area primarily blows from the southwest to the east-northeast, particularly in the months of October through March. Wind data collected at the Great Falls International Airport, approximately 5 miles southwest of the community of Black Eagle show that during March, April, and May the winds can blow from the northwest or northeast more than twenty percent of the time and that in the summer months of June, July, and August wind direction over Black Eagle is from the northeast or east more than 20 percent of the time (Ref. 30, pp. 2-13). A historic south facing aerial photo published by the Great Falls Tribune in 2002 shows smoke from the 506 foot tall stack wafting westward across the community of Black Eagle with the city of Great Falls shown in the background beyond the Missouri River (Ref. 29, p. 8A). Area ranchers began complaining about contamination from the smelter and refinery stack falling on their property and adversely affecting their livelihood in the early 1900s (Ref. 31). Chemical assays of flue dust and top soil near the stack performed by Boston & Montana chemists in 1904 and 1905 concluded that over 40 pounds of arsenic trioxide (As_2O_3) had been deposited per acre by March of 1904 at a distance 6.24 miles from the stack (Ref. 32, p. 2). Additional sampling at new locations performed in 1905 concluded that almost 14 pounds of arsenic trioxide (As_2O_3) had been deposited at 2.5 miles from the stack (Ref. 47, p. 2). An internal Anaconda Copper Mining Company Memorandum from 1951 stated that approximately 15.04 pounds of arsenic passed out of the stack every 24 hours (Ref. 33, p. 1). For these reasons, aerial deposition of contaminants emanating from the smelter smoke stacks between 1893 and 1972 is the most likely mechanism of contaminant transport to the residential soils in the community of Black Eagle.

The Boston and Montana smelter routinely dumped large quantities of granulated slag and tailings into the Missouri River (Ref. 6, p. 42; Ref. 15, p. 1). In 1907, the Boston and Montana Consolidated Copper and Silver Mining Company estimated that the facility could receive up to 4800 tons a day of ore and changing the disposal of slag to railcar would significantly increase rail traffic (Ref. 14, p. 1). The Montana Department of Environmental Quality (Montana DEQ) estimates that between 27,500,000 and 31,000,000 cubic yards of waste were dumped into the Missouri River between 1893 and 1915 until onsite containment was instituted in 1915. Montana DEQ also reports that it is possible that dumping of waste into the Missouri River continued at a reduced rate after 1915 until the facility closed in the 1970s (Ref. 16, p. 1). So much smelter waste was dumped into the Missouri River between 1893 and 1915 that the management and legal department of the Boston and Montana Company were concerned that the Federal Government would intervene and enjoin the deposition of tailings into the Missouri River by virtue of the constitutional provisions requiring the federal government to maintain navigable streams (Ref. 15, pp. 1 and 2). In 1884 Judge Lorenzo Sawyer of the United States Circuit Court in San Francisco had granted a perpetual injunction against hydraulic mining in California's American River on these very grounds (Ref. 6, p. 38).

Numerous complaints were filed by property owners and communities along the Missouri River downstream of the ACM Smelter and Refinery of water quality issues and slag and smelter waste clogging the Missouri River (Ref. 6, p. 42; Ref. 29, p. 8A). These complaints increased after the 1908 flood of the Missouri River inundated the community of Fort Benton, 40 miles downstream of the Boston and Montana Smelter with smelter waste (Ref. 6, p. 38; Ref. 29, p. 8A). A company analysis of slime (very fine grained slag and tailings, which tended to float in the Missouri River) taken above Rainbow Falls Dam in 1914 indicated that the slime contained between .55 and 1.1 percent copper (Ref. 17, p. 1). The Boston and Montana Company sought to buy off disgruntled property owners and placate communities by providing alternate domestic water sources (Ref. 6, pp. 49-51).

The Montana DEQ collected the first samples of Missouri River sediment for environmental analysis in May of 2002. These samples were collected from the Fort Benton area, approximately 30 miles downstream from the ACM Smelter and Refinery. The Montana DEQ concluded that the five samples that had been collected contained anomalously high levels of antimony, arsenic, copper, lead, zinc, and other metals and recommended that additional samples be taken from the smelter site in Black Eagle down to Judith Landing (State Highway 287) (Ref. 16, p. 2).

The EPA conducted an Expanded Site Inspection of the ACM Smelter and Refinery facility in April 2003 that included source samples and nine sediment samples from the Missouri River (Ref. 18, p. 8). Elevated concentrations of arsenic, cadmium, copper, lead, manganese, mercury, silver and zinc were detected in most of the samples as compared to background (Ref. 18, pp. 23-24).

The current owner, Atlantic Richfield Company, conducted a limited study of sediment, surface water and fish tissue from the Missouri River near the facility in November, 2004 (Ref. 19, p.7). Their conclusions of the investigation were that concentrations of metals adjacent to and downstream of the ACM Smelter and Refinery facility were comparable to or even less than background concentrations of the metals (Ref. 19, p. 8). A review of the report by the EPA's Regional Ecological toxicologist noted that at three sample locations ecotoxicological benchmarks were exceeded in soil samples, and it is likely that higher concentrations of metals in all samples could have been obtained by taking samples on the north side of the Missouri River, which is the same side as the facility rather than across the River on the south bank of the Missouri River (Ref. 20, pp.1, 2).

The EPA conducted a Site Assessment of the residential soil in Great Falls, Montana south of the site of the former refinery and smelter and in the community of Black Eagle, Montana in 2007. Between the dates of August 8 and 15, 2007, samples were collected from sixty-three residential properties. The 2007 investigation identified a large area of elevated concentrations of arsenic, cadmium, and lead in the

community Black Eagle and one property in Great Falls contained an elevated concentration (Ref. 21, p.18; Ref. 22, pp. 1-2).

The EPA conducted an Expanded Site Inspection of the residential soils in the community of Black Eagle, Montana in 2008 utilizing the same sample collection and analytical procedures as the 2007 investigation (Ref. 21, pp. 11-12; Ref. 5, p. 11). Between the dates of July 8 and 16, 2008 samples were collected from fifty-nine residential properties (Ref. 5, p. 1). The 2008 investigation also identified a large area of elevated arsenic and lead concentrations in residential soil as compared to background in an area centered on the central and southwestern area of the community of Black Eagle (Ref. 5, p. 13; Ref. 22 pp. 1-2).

The EPA conducted an Expanded Site Inspection of the sediments in the Missouri River adjacent to and downstream of the ACM Smelter and Refinery property in July 2009. On July 14, eight sediment samples were collected from along the north side of the Missouri River channel between the 11th Street Bridge and Rainbow Dam (Ref. 23, pp. 15 and 21). This investigation identified a stream segment of 2.39 miles with concentrations of copper, lead, and silver (Ref. 23, p. 21). This segment of the Missouri River includes widely used fishing areas (Ref. 34, p. 2). Fishing was observed by the sampling team during the 2009 Expanded Site Inspection (Ref. 23, p. 14, 23, 28, and 33). The Montana Department of Fish, Wildlife and Parks estimates that a population of 1,292 rainbow trout and 302 brown trout are found in the 1.5 mile stretch between Black Eagle Dam and Giant Springs State hatchery based on an electroshock survey done before stocking in the summer of 2000 (Ref. 34, p. 1). The fish that are caught along this stretch of the river are eaten by the anglers and their families (Ref. 44; Ref. 45; and Ref. 46).

2.2.1 SOURCE IDENTIFICATION

Name of the Source: Black Eagle Residential Soil

Number of Source: 1

Source Type: contaminated soil

Description and Location of the source:

Residential soil contamination in the unincorporated residential community of Black Eagle located on the north bank of the Missouri River across from Great Falls, Montana, was first documented by the EPA's 2003 Expanded Site Inspection when elevated concentrations of antimony, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, silver, sodium, and zinc were found in one or more samples (Ref. 4, map 1; Ref. 18, pp. 28-30).

The 2007 EPA CERCLA Site Assessment sampled residences on both the north and south sides of the Missouri River adjacent to the Anaconda Minerals Co, Great Falls Refinery (Ref. 21, p. 11). Of the eleven residences sampled in Great Falls on the south side of the Missouri River in August of 2007 only one residence had an elevated concentration of arsenic (Ref. 21, p. 13). The results of the 2007 investigation of the residential soil in the community of Black Eagle identified an area of arsenic, cadmium, and lead concentrations greater than three times background centered on eastern and central Black Eagle (Ref. 21, p. 13-14, 18).

The 2008 EPA CERCLA Expanded Site Investigation was focused in the unincorporated community of Black Eagle, Montana. The residential soil at fifty nine residential properties in Black Eagle was sampled in July 2008 to a depth of one foot (Ref. 5, p. 1). Concentrations of arsenic, cadmium, and lead elevated three times background were detected in the residential soil in Black Eagle centered on the central and southwestern area of Black Eagle (Ref. 5, p. 13; Ref. 22, pp. 1-2).

The regional setting of the community of Black Eagle, the Missouri River, Great Falls, and the ACM Smelter and Refinery are shown in Figure E (Ref. 42, 1 page). For this document the combined area of arsenic and cadmium contamination (not corrected for covered soil) greater than three times background and above a health based benchmark was used to define the source. Samples from the 0-2 inch horizon were compared to background samples from the 0-2 inch horizon, and samples from the 6-12 inch horizon were compared to the background samples from the 6-12 inch horizon. There are eight sample locations with arsenic or cadmium concentrations greater than times background and are above a health based benchmark. There are an additional forty-five locations where cadmium and/or lead concentrations are simply greater than three times background (see Section 2.2.1.2 of this HRS documentation record). Lead contamination was not used to calculate the area of contaminated soil, but elevated lead concentrations are presented to show that a pattern of contamination is pervasive throughout the area delineated by the arsenic and cadmium results. The area of soil delineated by the 2007 and 2008 investigation results for residential soil contaminated by arsenic and cadmium is 1,926,569 square feet (Ref. 22, pp.1- 2). Areas were calculated using Global Positioning System (GPS) coordinates of the sample locations and processed with geographic information system (GIS) software (Ref. 24, p. 1).

The background samples used to calculate the values to determine the residential soil source area are presented in the table below. Two locations were sampled in 2007 from the 0-2 inch and 6-12 inch horizon and two locations were sampled from the 0-2 inch horizon in 2008 (Ref. 5, p. 10; Ref. 21, p. 11; Ref. 36, book 2, p. 3 & book 3, pp. 17-18; Ref. 52, pp. 15-16, 28; Ref. 49, 1 page). The highest background sample result for each of the horizons was selected as the background sample for that horizon. All background values selected were obtained from 2007 background samples with four of the six background values derived from the background samples collected from North Middle School (R08ST2601F102 and R08ST2601F112), which

was also the location of the 2004 soil background sample (Ref. 18, p. 27). All samples were collected as grab samples following the guidelines of the UOS TSOPs using stainless steel spoons, bowls, and hand augers to collect the soil into 12X12 inch seal top poly bags. The 0-2 inch horizon was collected directly into the plastic zip lock bag using a stainless steel spoon, and the 6-12 inch horizon was collected using a hand auger into a stainless steel bowl where the soil was lightly homogenized by stirring before a sample was collected into 12X12 inch seal top poly bags (Ref. 5, p. 11; Ref. 21, pp. 11-12). All of the background samples were collected from the area north of the Missouri River, west of the site, in soils developed on the Kootenai Formation which also underlies the community of Black Eagle (Ref. 5, p. 5; Ref. 10. 1 sheet; Ref. 21, p. 4). The soil was moist, fine-grained well sorted silty sand at the locations (Ref. 52, pp. 15-16 & 28). All soil samples collected were analyzed in the field using an x-ray fluorescence (XRF) unit (Ref. 5, p. 12; Ref. 21, p. 12). All samples for fixed laboratory analyses were analyzed through the EPA's Contract Laboratory Program (CLP), Routine Analytical Services (RAS). The samples collected in 2007 were analyzed by A4 Scientific, Inc. of The Woodlands, Texas by EPA CLP method ILM05.4 (Ref. 60, p. 1; Ref. 61, p. 1; Ref. 62, p. 1). The samples collected in 2008 were analyzed by Chemtech Consulting Group, Mountainside, New Jersey by EPA CLP method ILM05.4 (Ref. 63. p. 1; Ref. 64, p. 1).

***ACM Smelter and Refinery – Background Samples 0-2 inch horizon collected in 2007 and 2008 (mg/kg)**

Analyte	CRDL/ MDL(2007/2008)	SCDM Benchmark CRSC/ RDSC	Jaycee Park R04ST2400F102 CLP - MHIH26 Sampled 8/10/2007	North Middle School R08ST2601F102 CLP - MH1H34 Sampled 8/8/2007	724 25th Ave. R25AV0724FY02 CLP - MH26P6 Sampled 7/11/2008	737 25th Ave. R25AV0737SY02 CLP - MH26P7 Sampled 7/11/2008
Arsenic	1/(0.49/0.37)	0.43	13.3	(10.4 J) **18.1**	6.3	16.1
Cadmium	0.5/(0.20/0.040)	39	**1.2 J+**	0.82 J+	0.53	(0.34 J) 0.48
Lead	1/(0.49/0.25)	-	**30.1**	(17.5 J) 25.2	25.3	20.6
Reference	Ref. 64, p. 51; Ref. 60, p. 64; Ref. 61, p. 64;	Ref. 2, pp. BII-13, BII-14, BII-20	Ref. 21, p. 29; Ref. 51, pp. 117, 120, 124, 138; Ref. 52. p. 28; Ref. 60, pp. 1, 3, 6, 8, 18, 78, 363-365, 594, 599, 604;	Ref. 21, p. 29; Ref. 51, pp. 2, 5, 9, 16; Ref. 52, pp. 15-16; Ref. 61, pp. 1, 3, 8, 9, 13, 219-221, 560, 566, 570,	Ref. 5, pp. 28-31, Appendix C, p. 56. Ref. 24, p. 3, Ref. 27, pp. 2, 3B, 3C, 3F, 3G, 3H, 9; Ref. 36, book 2, p. 3 & book 3, pp. 17-18; Ref. 64. pp. 1, 4, 7, 9, 15, 79.	Ref. 5, p. 28, & Appendix C, p. 56. Ref. 24, p. 3. Ref. 27, pp. 2, 3B, 3C, 3G, 3H, 10; Ref. 36, Book 2, p. 3; Ref 64, pp. 1, 4, 7, 9, 16, 80.

* Sample IDs ending in 02 represent samples collected from 0-2 inches (Ref. 5, p. 10; Ref. 21, p. 11).
Bold Indicates background value selected for this document / mg/kg
CRSC Cancer Risk Screening Concentration
RDSC Reference Dose Screening Concentration
J The associated numerical value is an estimated quantity and is the approximate concentration of the analyte in the sample.
J+ The associated numerical value is an estimated quantity, but the result may be biased high.
( ) Validated value prior to adjustment as per EPA Fact Sheet "Using Qualified Data to Document an Observed Release and Observed Contamination" (Ref. 43, 18 pages).
mg/kg milligrams per kilogram

****ACM Smelter and Refinery – Background Samples 6-12 inch horizon collected in 2007 (mg/kg)**

Analyte	CRDL/MDL	SCDM Benchmark CRSC/RDSC	Jaycee Park R04ST2400F112 CLP - MHIH27 Sampled 8/10/2007	North Middle School R08ST2601F112 CLP - MH1H35 Sampled 8/8/2007	724 25th Ave. 6-12 inch sample not collected in 2008	737 25th Ave. 6-12 inch sample not collected in 2008
Arsenic	1/0.49	0.43	17.2	(13.3 J) **23.1**	-	-
Cadmium	0.5/0.20	39	0.43 J+	**0.67 J+**	-	-
Lead	1/0.49	-	10.6	(12.9 J)**18.6**	-	-
Reference	Ref. 60, p. 64; Ref. 61, p. 64;	Ref. 2, pp. BII-13, BII-14, BII-20	Ref. 21, pp. 29-32; Ref. 51, pp. 117, 120, 124, 139; Ref. 52. p. 28; Ref. 60, pp. 1, 3, 5, 6, 8, 19, 117, 120, 124, 139, 366-368.	Ref. 21, pp.29-32; Ref. 51, pp. 2, 5, 9, 17; Ref. 52, pp. 15-16; Ref. 61, pp. 1, 3, 5, 8, 9, 14, 222-224	-	-

** Sample IDs ending in 12 represent samples collected from 6-12 inches (Ref. 5, p. 10; Ref. 21, p. 11).
Bold Indicates background value selected for this document / mg/kg

CRSC	Cancer Risk Screening Concentration
RDSC	Reference Dose Screening Concentration
J	The associated numerical value is an estimated quantity and is the approximate concentration of the analyte in the sample.
J+	The associated numerical value is an estimated quantity, but the result may be biased high.
( )	Validated value prior to adjustment as per EPA Fact Sheet "Using Qualified Data to Document an Observed Release and Observed Contamination" (Ref. 43, 18 pages).
mg/kg	milligrams per kilogram

2.2.1.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

The following table lists all detections of arsenic, cadmium, and lead from the 2007 and 2008 EPA investigations of the residential soils in Black Eagle, Montana which meet the HRS definition of greater than three times background (Ref. 1, Table 2-3, p. 51589).

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
R11ST0111FY02 MH26N3	111 11th Street	07/11/2008	73.2	3	261	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5. Appendix C, p. 54. Appendix D, p. 1; Ref. 24, p. 1; Ref. 36, book 1, p. 5; Ref. 27, pp. 24, 27, 31, 32, 39; Ref. 63, pp. 1, 4, 7, 7A, 13. 62, 283.
R12ST0106FY12 MH26N4	106 12th Street	07/11/2008	30.6	2.7	98.7	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5. Appendix C, p. 53. Appendix D, p.5; Ref. 24, p. 1; Ref. 27, pp. 24, 27, 31, 32, 40; Ref. 36, book 1, p. 4; Ref. 63, pp. 1, 4, 7, 7A, 14, 62, 283.
R12ST0121FY112 MH26N5	121 12th Street	07/11/2008	215	13	706	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 50-51. Appendix D, p.8; Ref. 24, p. 1; Ref. 27, pp. 24, 27, 31, 41; Ref. 36, book 3, p. 17; Ref. 63, p. 1, 4, 7, 7A, 15, 62, 283.
R13ST0112BY02 MH26N6	112 13th Street	07/10/2008	47.3	44.9	562	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 45-47. Appendix D, p.9; Ref. 24, p. 1; Ref. 27, pp. 24, 27, 31, 42; Ref. 36, book 3, p. 12; Ref. 63, pp. 1, 4, 7, 7A, 16, 62, 283.
R13ST0117FY02 MH26N7	117 13th Street	07/11/2008	21.4	69.1	439	As = 1/0.37/0.43 Cd = 0.50.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 7-8. Appendix D, p.10; Ref. 24, p. 1; ref. 27, pp. 24, 27, 31, 32, 43; Ref. 36, book 1, p. 6-

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
							7; Ref. 63, pp. 1, 4, 7, 7A, 17, 62, 143, 283.
R13ST0121F112 MH1H38	121 13th Street	08/11/2007	(66.8 J) 38.4	(2.5 J+) 1.8	(754 J) 523.6	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 30, Appendix C, p. 4, Appendix D, p.2; Ref. 51, pp. 2, 5, 8, 9, 10, 12, 20; Ref. 61, pp. 1, 3, 5, 8, 9, 17, 64, 288-290.
R13ST0123FY02 MH26N9	123 13th Street	07/12/2008	16.5	9.2	432	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 7. Appendix D, p.14; Ref. 24, p. 1; Ref 27, 24, 27, 31, 32, 45; Ref. 36, book 2, p. 5; Ref. 63, pp. 1, 4, 7, 7A, 19, 62, 148, 283
R13ST0127FY12 MH26P0	127 13th Street	07/12/2008	36.3	7.8	340	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 8. Appendix D, p.15; Ref. 24, p. 1; Ref. 27, 24, 27, 31, 32, 46; Ref. 36, book 2, p. 8; Ref. 63, pp. 1, 4, 7, 7A, 20, 62, 149, 283.
R14ST0122F102 MH1H39	122 14th Street	08/11/2007	(24.2 J) 13.9	111	(607 J) 421.5	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 29, Appendix C, p. 34, Appendix D, p. 3; Ref. 51, pp. 2, 5, 8, 10, 12, 21; Ref. 52, p 34; Ref. 61, pp. 1, 3, 5, 8, 9, 18, 291-293, 495-497
R16ST0121BY12 MH26P1	121 16th Street	07/14/2008	67.8	14.5	333	As = 1/0.37/0.43 Cd = 0.50.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 25. Appendix D, p.17; Ref. 24, p. 3; Ref. 27, pp. 2, 3B, 3G, 3H, 4; Ref. 36, book 2, p. 14; Ref. 61, pp. 1, 4, 7, 9, 10, 64, 74, 182, 184.
R15ST0215B102 MH1H40	215 15th Street	08/08/2007	(18 J) 10.3	11.6	(553 J) 384.0	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 29, Appendix C, p. 5, Appendix D, p. 4; Ref. 51, pp. 2, 5,

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
							10, 12, 22; Ref. 61, pp. 1, 3, 5, 8, 9, 19, 64, 294-296
R15ST0307F112 MH1H41	307 15th Street	08/08/2007	(39.8 J) 22.9	(2.2 J +) 1.6	(789 J) 547.9	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 30, Appendix C, p. 5, Appendix D, p. 5; Ref. 51, pp. 2, 5, 8, 9, 10, 12, 23; Ref. 61, pp. 1, 3, 5, 8, 9, 20, 64, 297-299, 381-383,
R16ST0128F112 MH1H43	128 16th Street	08/11/2007	(34.5 J) 19.8	(2.3 J+) 1.6	163	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 30, Appendix C, p. 6, Appendix D, p. 7; Ref. 51, pp. 46, 49, 52, 53, 54, 56, 60; Ref. 62, 1, 3, 8, 9, 13, 64, 112-114.
R17ST0122F112 MH1H44	122 17th Street	08/11/2007	(60.1 J) 34.5	(27 J) 19.2	967	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 30, Appendix C, p. 7, Appendix D, p. 8; Ref. 51, pp. 46, 49, 54, 56, 61; Ref. 62, pp. 1, 3, 8, 9, 14, 64, 115-117, 432-434.
R17ST0125F112 MH1H45	125 17th Street	08/12/2007	(43.5 J) 25	(6.9 J) 4.9	162	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 30, Appendix C, p. 7, Appendix D, p. 9; Ref. 51, pp. 46, 49, 54, 56, 62; Ref. 62, pp. 1, 3, 8, 9, 15, 64, 118-120.
R20ST0118BY12 MH26P3	118 20th Street	07/10/2008	22.8	9.4	319	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 47. Appendix D, p.22; Ref. 24, p. 2; Ref. 27, pp. 2, 3B, 3F, 3G, 3H, 6; Ref. 36, book 3, p. 14; Ref. 64, pp. 1, 4, 7, 9, 12, 51, 76, 180, 182
R21ST0328FY12 MH26P4	328 21st Street	07/15/2008	72.4	2.5	86.2	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 37. Appendix D, p.25; Ref. 24, p. 2; Ref. 27, 2, 3B,

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
							3C, 3F, 3G, 3H, 7; Ref. 36, book 2, p. 18; Ref. 64, pp. 1, 4, 7, 9,13, 51, 77, 180, 182.
R21ST0520FY12 MH26P5	520 21st Street	07/15/2008	47.5	2.6	90.1	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 35. Appendix D, p.30; Ref. 24, p. 2; Ref. 27, pp. 2, 3B, 3C, 3F, 3G, 3H, 8; Ref. 36, book 2, p. 19; Ref. 64, p. 1, 4, 7, 9, 14, 51, 78, 92.
R21ST0625F112 MH1H47	625 21st Street	08/10/2007	43.6	2.7	124	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 30, Appendix C, p. 37, Appendix D, p. 13; Ref. 51, pp. 118, 120, 125, 126, 147; Ref 52, p. 26; Ref. 60, pp. 1, 3, 6, 10, 27, 64, 456-458.
R21ST0641S112 MH1H48	641 21st Street	08/10/2007	38.4	2.8	199	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 30, Appendix C, p. 9, Appendix D, p. 14; Ref. 51, pp. 118, 120, 125, 126, 148; Ref. 60, pp. 1, 3, 6, 10, 28, 64, 459-461.
R22ST0114B112 MH1H50	114 22nd Street	08/09/2007	84.4	27.3	397	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 31 , Appendix C, p. 10, Appendix D, p. 15; Ref. 51, pp. 118, 120, 125, 150; Ref. 60, pp. 2, 3, 6, 10, 30, 64, 465-467.
R22ST0118F102 MH1H52	118 22nd Street	08/09/2007	(22.4 J) 12.9	25.8	(519 J) 399.2	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 29, Appendix C, p.11, Appendix D, p. 16; Ref. 51, pp. 2, 5, 8, 10, 12, 26; Ref. 61, pp. 1, 3, 5, 8, 10, 23, 64, 315-317, 390-395
R22ST0613B112	613 22nd Street	08/10/2007	(39.8 J)	7.8	(272 J)	As = 1/0.49/0.43	Ref. 2, pp. BII-13, BII-14, BII-20;

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
MH1H54			22.9		209.2	Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 21, p. 31, Appendix C, p. 38, Appendix D, p. 20; Ref. 51, pp. 2, 5, 8, 10, 12, 28; Ref. 52, p. 29; Ref. 61, pp. 1, 3, 5, 8, 11, 26, 64, 321-323, 420-422
R22ST0633B112 MH1H55	633 22nd Street	08/10/2007	(53.1 J) 33.2	2.9	(290 J) 223.1	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 31, Appendix C, p. 16, Appendix D, p. 22; Ref. 51, pp. 2, 5, 8, 10, 12, 29; Ref. 61, pp.1, 3, 5, 8, 11, 26, 64, 324-326, 423-425
R22ST0641B112 MH2174	641 22nd Street	08/09/2007	(88.8 J) 55.5	3.6	(223 J) 171.5	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 31, Appendix C, p. 17, Appendix D, p. 23; Ref. 51, pp. 3, 5, 8, 10, 12, 30; Ref. 61, pp. 1, 3, 5, 8, 11, 27, 64, 327-329, 426-428
RCHAV1820BY12 MH26Q0	1820 Chicago Ave.	07/13/2008	50.9	2.7	89.4	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, pp. 29, 65, Appendix C, pp. 23-24, Appendix D, p. 34, Ref. 27, pp. 2, 3B, 3C, 3F, 3G, 3H, 13; Ref. 64, pp. 1, 4, 7, 9, 19, 51, 85, 182, 185, 189.
RCOAV1508S112 MH2176	1508 Colorado Avenue	08/10/2007	(53.1 J) 33.2	(3 J+) 2.1	179	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 31, Appendix C, p.18, Appendix D, p. 26; Ref. 51, pp. 46, 49, 52, 53, 54, 56, 63; Ref. 62, pp. 1, 3, 8, 10, 16, 64, 121-123, 435-437
RCOAV1702BY12 MH26Q2	1702 Colorado Avenue	07/12/2008	29.3	1.6	76.7	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 11. Appendix D, p.37; Ref. 24, p. 4; Ref. 27, pp. 2, 3B, 3C, 3F, 3G, 3H, 15; Ref. 36, book 3, p. 5; Ref. 64, p. 1, 4, 7, 8, 21,

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
							51, 87.
RCOAV1711B102 MH2177	1711 Colorado Avenue	08/10/2007	(23.9 J) 13.7	(3.9 J) 2.8	94.6	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 29, Appendix C, p. 20, Appendix D, p. 29; Ref. 51, pp. 46, 49, 52, 54, 56, 64; Ref. 62, pp. 1, 3, 8, 10, 17, 64, 124-126.
RCOAV1903B112 MH2179	1903 Colorado Avenue	08/10/2007	(63.8 J) 39.9	(13.2 J) 9.4	866	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 31, Appendix C, p. 21, Appendix D, p. 31; Ref. 51, pp. 46, 49, 52, 54, 56, 65; Ref. 62, pp. 1, 3, 8, 10, 18, 64, 127-129, 438-440
RCOAV1904B112 MH2180	1904 Colorado Avenue	08/09/2007	(32.9 J) 18.9	(5.5 J) 3.9	224	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 31, Appendix C, p. 43, Appendix D, p. 32; Ref. 51, pp. 46, 49, 52, 54, 56, 66. Ref. 62, pp. 1, 3, 8, 10, 19, 64, 130-132, 441-443
RCOAV1906B112 MH2181	1906 Colorado Avenue	08/09/2007	(35.7 J) 20.5	(6.9 J) 4.9	216	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix C, p. 45, Appendix D, p. 33; Ref. 51, pp. 46, 49, 54, 56, 67; Ref. 52, pp. 22-23; Ref. 62, pp. 1, 3, 8, 11, 20, 64, 462-464
RCOAV1909BY02 MH26Q3	1909 Colorado Avenue	07/13/2008	29.3	13.1	394	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 14. Appendix D, p.39; Ref. 24, p. 3; Ref. 27, pp. 2, 3B, 3F, 3G, 3H, 16; Ref. 36, book 2, p. 7; Ref. 64 pp. 1, 4, 7, 8, 22, 51, 88.
RCOAV1917VG02 MH2182	1917 Colorado Avenue	08/09/2007	(6.8 J) 3.9	(3.8 J+) 2.7	119	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 21, p. 29, Appendix C, p. 22, Appendix D, p. 36; Ref. 51, pp. 46, 49, 52, 53, 54, 56, 68; Ref. 62, pp. 1, 3, 8, 11, 21, 64, 153-155, 559,

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
RCOAV1922B112 MH2183	1922 Colorado Avenue	08/09/2007	(27.6 J) 15.9	(1.8 J+) 1.3	68.7	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix C, p. 46, Appendix D, p. 37; Ref. 51, pp. 46, 49, 53, 69; Ref. 52, p. 20; Ref. 62, pp. 1, 3, 8, 11, 22, 64, 75, 156-158, 567, 568, 573.
RCOAV1923F112 MH2184	1923 Colorado Avenue	08/11/2007	35.3	3.8	152	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix C, p. 47, Appendix D, p. 38; Ref. 51, pp. 46, 49, 52, 53, 54, 56, 70; Ref. 52, p. 31; Ref. 62, pp. 1, 3, 8, 11, 23, 64, 177-179, 560.
RCOAV1925F112 MH2185	1925 Colorado Avenue	08/12/2007	(29.3 J) 16.8	(2.6 J+) 1.8	141	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix C, p. 23, Appendix D, p. 39; Ref. 51, pp. 46, 49, 52, 53, 54, 56, 71; Ref. 62, pp.1, 3, 8, 11, 24, 64, 180-182.
RMTAV1518FY02 MH26Q5	1518 Montana Avenue	07/15/2008	16.3	24.6	334	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 68. Appendix D, p.41; Ref. 24, p. 3; Ref. 27, pp. 3, 3B, 3F, 3G, 3H, 18; Ref. 64, pp. 1, 4, 7, 8, 24, 51, 89, 104.
RMTAV1708VG12 MH26Q7	1708 Montana Avenue	07/14/2008	67.3	1.2	75.8	As = 1/0.37/0.43 Cd = 0.50.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 43-44, Appendix D, p. 44; Ref. 24, p. 4; Ref. 27, pp. 3, 3B, 3C, 3F, 3G, 3H, 20; 20; Ref. 36, bk. 3, p. 11; Ref. 64, pp. 1, 4, 7, 8, 26, 51, 100.
RMTAV1716BY12 MH26Q8	1716 Montana Avenue	07/09/2008	9	11	536	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 41. Appendix D, p.46; Ref. 24, p. 3; Ref. 27, pp. 3,

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
							3B, 3F, 3G, 3H, 21; Ref. 36, book 3, p. 8; Ref. 64 p. 27, 51, 186, 189.
RMTAV1722FY02 MH26R0	1722 Montana Avenue	07/10/2008	30.3	3.8	147	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 43. Appendix D, p.48; Ref. 24, p. 3; Ref. 27, pp. 3, 3B, 3C, 3F, 3H, 29; Ref. 64, pp. 1, 4, 7, 8, 29, 51, 103.182, 187.
RMTAV1901FY12 MH26R1	1901 Montana Avenue	07/10/2008	43.4	2.9	148	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix D, p.50; Ref. 24, p. 3; Ref. 27. pp. 24, 27, 31, 32, 21; Ref. 63, pp. 1, 4, 7B, 21, 51, 62, 124, 285, 290, 295.
RMTAV1908F112 MH2186	1908 Montana Avenue	08/09/2007	(50.4 J) 29	(2.8 J+) 2	119	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix C, p. 48, Appendix D, p. 40; Ref. 51, pp. 46, 49, 52, 53, 54, 56, 72; Ref. 52, p21; Ref. 62, pp. 1, 3, 8, 11, 25, 64, 183-185.
RMTAV1912F102 MH2187	1912 Montana Avenue	08/09/2007	(14.4 J) 8.3	(4.8 J) 3.4	331	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 29, Appendix C, p. 49, Appendix D, p. 41; Ref. 51, pp. 46, 49, 52, 54, 56,73; Ref. 52, pp. 21-22; Ref. 62, pp. 1, 3, 5, 11, 26, 64, 186-188.
RMTAV1915BY12 MH26R3	1915 Montana Avenue	07/13/2008	75	0.5	26.7	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 20, Appendix D, p. 52; Ref. 24, p. 5; Ref. 27, pp. 24, 27, 31, 32, 49; Ref. 36, bk. 2, p. 11; Ref. 63, pp. 1, 4, 7B, 23, 51, 62, 128.
RMTAV1924B112	1924 Montana	08/10/2007	(55.5 J)	(3.6 J+)	112	As = 1/0.49/0.43	Ref. 2, pp. BII-13, BII-14, BII-20;

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
MH2189	Avenue		34.7	2.6		Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 21, p. 32, Appendix C, p. 50, Appendix D, p. 42; Ref. 51, pp. 47, 49, 52, 53, 54, 56, 75; Ref. 52, pp. 25-26; Ref. 62, pp. 1, 3, 5, 11, 28, 192-194.
RRBDR2720F102 MH2190	2720 Rainbow Dam Road	08/11/2007	(71.9 J) 44.9	(4.2 J) 3	141	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 29, Appendix C, p. 51, Appendix D, p. 43; Ref. 51, pp47, 49, 52, 54, 56, 76; Ref. 62, pp.1, 3, 5, 11, 29, 64, 195-197.
RRVAV2118B112 MH2191	2118 River Avenue	08/10/2007	(85.2 J) 53.3	(4.7 J) 3.3	1,650	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix D, p. 44; Ref. 51, pp. 47, 49, 52, 54, 56, 77; Ref. 62, pp. 1, 3, 5, 12, 30, 64, 198-200, 465-467.
RSMAV1605B112 MH2192	1605 Smelter Avenue	08/11/2007	(45.1 J) 25.9	(3.2 J+) 2.3	137	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix D, p. 45; Ref. 51, pp. 47, 49, 52, 53, 54, 56, 78; Ref. 62, pp.1, 3, 5, 12, 31, 64, 201-203, 486-488.
RSMAV1624B112 MH2193	1624 Smelter Avenue	08/11/2007	(72.6 J) 45.4	(2.7 J+) 1.9	280	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix D, p. 46; Ref. 51, pp. 47, 49, 52, 53, 54, 56, 79.Ref. 62, pp. 1, 3, 5, 12, 32, 64, 213-215.
RSMAV1917FY12 MH26R5	1917 Smelter Avenue	07/14/2008	42.7	3.8	167	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5. Appendix C, p. 27. Appendix D, p.56; Ref. 24, p. 5; Ref. 27, pp. 24, 27, 31, 32, 51; Ref. 36, book 2, p. 15; Ref. 63, pp. 1, 4, 7, 7B, 25, 62, 135.
RSMAV2021SY12	2021 Smelter	07/14/2008	53.1	13.5	351	As = 1/0.37/0.43	Ref. 2, pp. BII-13, BII-14, BII-20;

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
MH26R6	Avenue					Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 5. Appendix C, p. 67. Appendix D, p.57; Ref. 24, p. 4; Ref. 27, pp. 24, 27, 31, 32, 52; Ref. 63, pp. 1, 4, 7, 7B, 26, 51, 136.
RSMAV2233F102 MH2194	2233 Smelter Avenue	08/12/2007	(15 J) 8.6	6.7	(131 J) 100.8	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 29, Appendix C, p. 59, Appendix D, p. 49; Ref. 51, pp. 3, 5, 8, 10, 12, 33; Ref. 61, pp. 1, 3, 5, 8, 12, 30, 64, 354-356.

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
J+ The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample, but is biased high.
( ) Value prior to correction as per EPA guidance 9285-7-14FS "Using Qualified Data to Document an Observed Release and Observed Contamination" (Ref. 43, 18 pages).

Source Sample Information

The source samples listed above were collected during the 2007 and 2008 sampling efforts conducted by START for EPA. All samples were collected as grab samples following the guidelines of the UOS TSOPs using stainless steel spoons, bowls, and hand augers to collect the soil into 12X12 inch seal top poly bags. The 0-2 inch horizon was collected directly into the plastic zip lock bag using a stainless steel spoon and the 6-12 inch horizon was collected using a hand auger into a stainless steel bowl where the soil was homogenized by stirring before a sample was collected into 12X12 inch seal top poly bags (Ref. 5, p. 11; Ref. 21, pp. 11-12). All soil samples collected were analyzed in the field using a portable XRF unit (Ref. 5, p. 12; Ref. 21., p. 12). All samples that were analyzed in a fixed laboratory were analyzed through the EPA CLP, RAS for TAL total metals. Soil Samples for the 2007 investigation were delivered to A4 Scientific Inc. of The Woodlands, Texas on August 13, 2007 (Ref. 60, p. 3; 61, p. 3; Ref. 62, p. 3). The samples collected in 2007 were analyzed by EPA CLP method ILM05.4 (Ref. 60, p. 1; Ref. 61, p. 1; Ref. 62, p. 1). The analytical data was validated by TLI Solutions on December 7, 2007 (Ref. 51, p. 1). Soil samples for the 2008 investigation were delivered to Chemtech Consulting Group of Mountainside, New Jersey on July 18, 2008 (Ref. 63, p. 2, Ref. 64, p. 2). The analytical data was validated by TechLaw, Inc, of Golden Colorado on December 03, 2008 (Ref. 27, p. 1). All samples collected in 2008 were analyzed by EPA CLP method ILM05.4 (Ref. 5, p. 12; Ref. 21, p. 12; Ref. 63, p. 1; Ref. 64, p. 1). Analytical results from the soil samples indicate the presence of arsenic, cadmium, and lead at concentrations greater than three times background.

2.2.1.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Containment Description	Containment Value	References
Gas release to air:	NS	-
Particulate release to air:	NS	-
Release to groundwater:	NS	-
Release via overland migration and/or flood: There is no documentation of a maintained engineered cover or and functioning and maintained run-on control system and runoff management system. Building pads, streets, sidewalks, etc. cover less than half of the area, but are not engineered containment features. Surface water runoff flows directly into the Missouri River through a series of culverts.	10	Ref. 1, p. 51588, Table 2-2, p. 51609, Table 4-2; Ref. 5, Appendices C and D; Ref. 21, Appendix C; Ref. 55.

Notes: NS = Not Scored

2.4.2 HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity

Description

There are no Hazardous Constituent Quantity data available for the residential soil in Black Eagle, Montana to calculate a Hazardous Constituent Quantity value.

Sum (pounds): Not available (NA)
Hazardous Constituent Quantity Assigned Value: NA

2.4.2.1.2 Hazardous Wastestream Quantity

Description

Data are not available; it is not possible to calculate the Hazardous Wastestream Quantity.

Sum (pounds): NA
Sum of Wastestream Quantity/5000 (Ref. 1, Table 2-5): NA
Hazardous Wastestream Quantity Assigned Value: NA

2.4.2.1.3 Volume

Description:

The volume of contaminated soil has not been fully characterized; it is not possible to adequately determine the volume of this source.

Dimension of source (yd^3): NA
Volume Assigned Value: 0

2.4.2.1.4 Area

Description

Arsenic and cadmium results delineate an area of approximately 1,926,569 square feet (ft^2) (Ref. 22, p. 2).
Area Assigned Value: 1,926,569 ft^2

2.4.2.1.5 Source Hazardous Waste Quantity Value

1,926,569 ft^2 /34,000 = 56.66
Highest assigned value calculated from Ref. 1, p. 51591, Table 2-5: 56.66

2.2.1 SOURCE IDENTIFICATION

Name of the Source: East Ditch Dump

Number of Source: 2

Source Type: Landfill

Description and Location of the source:

East ditch dump is on a ridge above the Missouri River approximately 400 feet north of the River and approximately 3,500 feet east of the former stack (Ref. 18, Figure 2; Ref. 58, Appendix I). No continuous cap or soil cover is documented to be in place over the east ditch dump. Building/construction debris, stained soils, blister copper, and slag were observed on the surface and mixed in the soil throughout the landfill area during the 2003 EPA site inspection (Ref. 18, pp. 17, 22, and 32; Ref. 53, 1 page).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

Hazardous Substance	Evidence (total metals)			References
	Sample No. / CLP No.	Concentration (mg/kg)	Background	
Arsenic	**AM-SO-03 / MX0XH0**	377	23.1	Ref. 18, p. 94; Ref. 21, p. 29-32; Ref. 51, pp. 2, 5, 9, 16, 17, 117, 120, 124, 138; Ref. 52. pp. 15-16, 28; Ref. 60, pp. 1, 3, 6, 8, 18, 78, 363-365, 594, 599, 604; Ref. 61, pp. 1, 3, 5, 8, 9, 13-14, 219-224
Cadmium	**AM-SO-03 / MX0XH0**	89.8	1.2 J+	
Lead	**AM-SO-03 / MX0XH0**	4270	30.1	
Manganese	**AM-SO-03 / MX0XH0**	899	-	
Zinc	**AM-SO-03 / MX0XH0**	4060	-	

Source Sample Information

The source sample listed above was collected in April 2003 during the Expanded Site Inspection conducted by Tetra Tech EM Inc. for EPA. All samples were analyzed through the EPA CLP, RAS for total metals. Soil samples for inorganic analysis were delivered to Sentinal Inc, of Huntsville, Alabama (Ref. 18, p. 3). The analytical data was validated by Tetra Tech, EM, Inc, of Chicago, IL on July 30, 2003 (Ref. 18, p. 56). Analytical results from the sample indicate the presence of arsenic, cadmium, copper, lead, manganese, silver, and zinc in the East Ditch Dump (Ref. 18, p. 94).

Background Sample Information

The sample collected from the East Ditch Dump is compared to soil samples collected during the 2007 EPA Site Inspection. The East Ditch Dump sample was collected from the 0 to 24 inch horizon using a macrocore (Ref. 57, 1 page). The 0-2 inch horizon background soil sample was collected directly into a plastic seal top bag using a stainless steel spoon and the 6-12 inch horizon was collected with a hand auger into a stainless steel bowl where the soil was lightly homogenized by stirring before a sample was collected into 12X12 inch seal top poly bags (Ref. 5, p. 11; Ref. 21, pp. 11-12). The background samples were collected from the area

north of the Missouri River, west of the site, in soils developed on the Kootenai Formation (Ref. 10. 1 sheet). The soil was moist, fine-grained well sorted silty sand at the locations (Ref. 52, pp. 15-16 & 28).

The highest background sample values available for the surface soil are 23.1 mg/kg arsenic, 1.2 J+ mg/kg for cadmium, and 30.1 mg/kg for lead.

***ACM Smelter and Refinery – Background Samples 0-2 inch horizon collected in 2007 and 2008 (mg/kg)**

Analyte	CRDL/ MDL(2007/2008)	Jaycee Park R04ST2400F102 CLP - MHIH26 Sampled 8/10/2007	North Middle School R08ST2601F102 CLP - MH1H34 Sampled 8/8/2007	724 25th Ave. R25AV0724FY02 CLP - MH26P6 Sampled 7/11/2008	737 25th Ave. R25AV0737SY02 CLP - MH26P7 Sampled 7/11/2008
Arsenic	1/(0.49/0.37)	13.3	(10.4 J) 18.1	6.3	16.1
Cadmium	0.5/(0.20/0.040)	**1.2 J+**	0.82 J+	0.53	(0.34 J) 0.48
Lead	1/(0.49/0.25)	**30.1**	(17.5 J) 25.2	25.3	20.6
Reference	Ref. 64, p. 51; Ref. 60, p. 64; Ref. 61, p. 64.	Ref. 21, p. 29; Ref. 51, pp. 117, 120, 124, 138; Ref. 52. p. 28; Ref. 60, pp. 1, 3, 6, 8, 18, 78, 363-365, 594, 599, 604;	Ref. 21, p. 29; Ref. 51, pp. 2, 5, 9, 16; Ref. 52, pp. 15-16; Ref. 61, pp. 1, 3, 8, 9, 13, 219-221, 560, 566, 570,	Ref. 5, pp. 28-31, Appendix C, p. 56. Ref. 24, p. 3, Ref. 27, pp. 2, 3B, 3C, 3F, 3G, 3H, 9; Ref. 36, book 2, p. 3 & book 3, pp. 17-18; Ref. 64. pp. 1, 4, 7, 9, 15, 79.	Ref. 5, p. 28, & Appendix C, p. 55. Ref. 24, p. 2. Ref. 27, pp. 2, 3B, 3C, 3G, 3H, 10; Ref. 36, Book 2, p. 3; Ref 64, pp. 1, 4, 7, 9, 16, 80.

Bold Indicates background value selected for the contaminated landfill soil / mg/kg
J The associated numerical value is an estimated quantity and is the approximate concentration of the analyte in the sample.
J+ The associated numerical value is an estimated quantity, but the result may be biased high.
( ) Validated value prior to adjustment as per EPA Fact Sheet "Using Qualified Data to Document an Observed Release and Observed Contamination" (Ref. 43, 18 pages).
mg/kg milligrams per kilogram

****ACM Smelter and Refinery – Background Samples 6-12 inch horizon collected in 2007 (mg/kg)**

Analyte	CRDL/MDL	Jaycee Park R04ST2400F112 CLP - MHIH27 Sampled 8/10/2007	North Middle School R08ST2601F112 CLP - MH1H35 Sampled 8/8/2007	724 25th Ave. 6-12 inch sample not collected in 2008	737 25th Ave. 6-12 inch sample not collected in 2008
Arsenic	1/0.49	17.2	(13.3 J) **23.1**	-	-
Cadmium	0.5/0.20	0.43 J+	0.67 J+	-	-
Lead	1/0.49	10.6	(12.9 J)18.6	-	-
Reference	Ref. 60, p. 64; Ref. 61, p. 64.	Ref. 21, pp. 29-32; Ref. 51, pp. 117, 120, 124, 139; Ref. 52. p. 28; Ref. 60, pp. 1, 3, 5, 6, 8, 19, 117, 120, 124, 139, 366-368.	Ref. 21, pp.29-32; Ref. 51, pp. 2, 5, 9, 17; Ref. 52, pp. 15-16; Ref. 61, pp. 1, 3, 5, 8, 9, 14, 222-224	-	-

Bold Indicates background value selected for the contaminated landfill soil / mg/kg
J The associated numerical value is an estimated quantity and is the approximate concentration of the analyte in the sample.
J+ The associated numerical value is an estimated quantity, but the result may be biased high.
( ) Validated value prior to adjustment as per EPA Fact Sheet "Using Qualified Data to Document an Observed Release and Observed Contamination" (Ref. 43, 18 pages).
mg/kg milligrams per kilogram

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Containment Description	Containment Value	References
Gas release to air:	NS	-
Particulate release to air:	NS	-
Release to groundwater:	NS	-
Release via overland migration and/or flood: No continuous maintained engineered cover, cap or soil cover is documented to be in place over the east ditch dump and waste was observed in the upper two feet of soil at the site in 2003. There is no documentation of a run-on control system and run-off is allowed to flow unchecked to concrete channels which direct run-off southward to the Missouri River.	10	Ref. 1, p. 51588, Table 2-2; p 51609, Table 4-2; Ref 53, 1 page.

Notes: NS = Not Scored

2.4.2 HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity

Description

There are no Hazardous Constituent Quantity data available for the East Ditch Dump to calculate a Hazardous Constituent Quantity value.

Sum (pounds): Not available (NA)
Hazardous Constituent Quantity Assigned Value: NA

2.4.2.1.2 Hazardous Wastestream Quantity

Description

There are no data available for the East Ditch Dump to calculate the Hazardous Wastestream Quantity.

Sum (pounds): NA
Sum of Wastestream Quantity/5000 (Ref. 1, Table 2-5): NA
Hazardous Wastestream Quantity Assigned Value: NA

2.4.2.1.3 Volume

Description:

The volume of contaminated soil at the East Ditch Dump has not been fully characterized; it is not possible to adequately determine the volume of this source.

Dimension of source (yd^3): NA
Volume Assigned Value: 0

2.2.2.4.4 Area

Description

The area covered by the East Ditch Dump is currently not quantifiable; however as contamination has been documented at the source can be said to be unknown but greater than zero (see Source 2, section 2.2.2 of this HRS documentation record; Ref. 58, Appendix I).

Area Assigned Value: Unknown but >0

2.4.2.1.4 Source Hazardous Waste Quantity Value

>0/3,400 = >0

The Source Hazardous Waste Quantity Value for the East Ditch is unknown but > 0 (Ref. 1, Section 2.4.2.1.5, Table 2-5, p. 51591).

Source Hazardous Waste Quantity Value: > 0

SUMMARY OF SOURCE DESCRIPTIONS

Source No.	Source Hazardous Waste Quantity Value	Source Hazardous Constituent Quantity Complete? (Y/N)	Available to Pathway (X)				
			Groundwater (GW)	Surface Water (SW)		Air	
				Overland/ flood	GW to SW	Gas	Particulate
1	56.66	N	NS	X	NS	NS	NS
2	> 0	N	NS	X	NS	NS	NS
Total	**56.66**						

Description of Other Possible Sources:

Fourteen additional source areas on the ACM Smelter and Refinery property were identified and sampled in April of 2003 by Tetra Tech EM, Inc. for an EPA Expanded Site Inspection (Ref. 18, pp. 8, 18-22, 38). Soil cover of these sources ranged from non-existent to 10 inches deep (Ref. 1, p. 51646, Section 5.01; Ref. 18, p. 22). The contaminates associated with one or more of these sources included antimony, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc (Ref. 18, pages 19-20). Culverts have been identified that drain surface water from the ACM Smelter and Refinery property directly into the Missouri River (Ref. 23, p. 31). The following table describes these possible sources:

Samples of Other Possible Sources
(Ref. 18, pp 18-20, 22, 32, 92, 93, 95-104, 117, 118)

Sample Location Description	Sample Number	Contaminant Levels (ppm – mg/kg)	Soil Cover (inches)
Waste pile in zinc plant dump	AM-SO-01	Cd – 70.8, Cu – 1,440, Pb – 5,190, Ag – 14.7, Zn – 20,700	8
Former lagoon area	AM-SO-02	Cd – 14.0, Cu – 346, Pb – 90, Ag – 2.8J, Zn – 1,350	6
Landfill	AM-SO-04	Cd – 1.7, Cu – 71.5, Pb – 17.3, Ag – .67J, Zn – 114	0
West ditch dump	AM-SO-05	Cd – 13.1, Cu – 239, Pb – 111, Ag – .8J, Zn – 2,150	4
Slag dump	AM-SO-06	Cd – 189, Cu – 1,250, Pb – 3,120, Ag – 15J, Zn – 21,500	0
Electric copper Refinery	AM-SO-07	Cd – 443, Cu – 2,370, Pb – 2,630, Ag – 30.2 J, Zn – 22,900	0
Arsenic Plant	AM-SO-08	Cd – 4.9, Cu – 669, Pb – 45.5, Ag – 1.9J, Zn – 322	10
North of the electric copper Refinery	AM-SO-09	Cd – 28.4, Cu – 13,400, Pb – 1,230, Ag – 91.9 J, Zn – 2,430	8
Zinc plant	AM-SO-10	Cd – 479, Cu – 2,530, Pb – 7,070, Ag – 48 J, Zn – 38,700	0
Aluminum rolling mill	AM-SO-11	Cd – 17.6, Cu – 8,090, Pb – 371, Ag – 3 J, Zn – 3,200	0
Copper rod mill	AM-SO-12	Cd – 3.9, Cu – 2,470, Pb – 107, Ag – .38 UJ, Zn – 672	0
West of the general laboratory	AM-SO-13	Cd – 1.1U, Cu – 30, Pb – 10.2, Ag – 2.1 UJ, Zn – 119	9
West of the general laboratory	AM-SO-14	Cd – 303, Cu – 4,360, Pb – 1,350, Ag – 9.4J, Zn – 5,810	8
Near smelter buildings	AM-SO-15	Cd – 180, Cu – 721, Pb – 40, Ag – 3.7J, Zn – 1,970	5

J The analyte was positively identified; the associated numerical value is the approximate concentration in the sample
U the analyte was analyzed for, but was not detected above the reported sample quantitation limit.
ppm parts per million
mg/kg milligrams per kilogram

4.0 SURFACE WATER MIGRATION PATHWAY

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/Flood Component

Two sources have been evaluated at the ACM Smelter and Refinery site. The first source, Source 1, the contaminated soil in the community of Black Eagle (Ref. 22, p. 2) would enter the surface water pathway of the Missouri River via a series of culverts draining surface water runoff from the community into the Missouri River. All outfall culvert locations are on the north bank of the Missouri River and are identified from information provided by the Cascade County Public Works Department (Ref. 55, 12 pages; Ref. 59, pp. 1-2). The five of the outfall locations are listed in the following table. A map showing the locations is also provided (Ref. 50, 1 page).

Outfalls draining from Contaminated Residential Soil to the Missouri River (Ref. 50, p. 2; Ref. 55, 11 pages; Ref. 59, pp. 1-2)

Outlet Name	Outfall Location	Outfall Description	Drainage Area	Responsible Party
PPE#1, North River Road 9th to 15th Street-No. 2	630 feet east of 10th Street Bridge	24-inch diameter corrugated steel pipe	37 acres Western Black Eagle	Cascade County
PPE#2, North River Road 9th to 15th Street-No. 3	1,400 feet east of 10th Street Bridge	24-inch diameter corrugated steel pipe	8 acres Western Black Eagle along Missouri River	Cascade County
PPE#3, 15th Street Bridge North	60 feet west of 15th Street Bridge	30-inch diameter corrugated	132 acres Central Black Eagle	MDT and Cascade County
PPE#4, Black Eagle South East	East of 15th Street Bridge under North River Rd.	20-inch diameter corrugated steel pipe	22 acres South central Black Eagle	Cascade County
PPE#5, Anaconda Hills West (Coulee)	380 feet west of Black Eagle Dam	Twin 36-inch diameter corrugated steel pipes	188 acres Eastern Black Eagle, Moose Lodge, and golf course	Cascade County

The most upstream outfall for surface water runoff from the contaminated soil identified in the unincorporated community of Black Eagle would be outfall North River Road 9th to 15th Street No. 2 (PPE # 1) with a drainage area of approximately 37 acres (Ref 50, 1 page; Ref. 55, p. 7; Ref. 59, pp. 1-2). This outlet captures runoff from western edge of the community of Black Eagle and delivers the runoff through the outfall to the Missouri River (Ref. 50; Ref. 59, pp. 1-2). PPE # 2 delivers runoff from approximately 8 acres in western Black Eagle along the Missouri River to the river at the outfall named North River Road 9th to 15th Street. PPE # 3 drains approximately 132 acres in central Black Eagle to the Missouri River at the outfall named 15th Street Bridge North. PPE # 4 drains approximately 22 acres in south central Black Eagle at the outfall named Black Eagle South East. The eastern area of Black Eagle, approximately 188 acres including the Moose Lodge and the northeast quadrant of the golf course, drains through PPE # 5 into the Missouri River (Ref. 55, pp. 1-11; Ref. 50, 1 page; Ref. 59, pp.1-2). The surface water pathway for source 1-residential soil, would continue through Black Eagle Dam, past the sample collection locations of the 2003 and 2009 EPA investigations, through Rainbow Dam and Morony Dam to the 15-mile target distance limit (TDL) (Ref. 50, 1 page).

The probable point of entry (PPE #6) for wastes associated with source 2-the East Ditch Dump on the ACM Smelter and Refinery property is shown on the surface water pathway map (Ref. 18, p. 38; Ref. 50; Ref. 58, Appendix I). The overland flow route from the East Ditch Dump to the Missouri River is south off the ridge to the river through a gully for approximately 400 feet to the Missouri River (Ref. 4, map 1; Ref. 50; Ref. 58, Appendix I). However, other sources at the facility likely also have potential to release by overland flow due to lack of cover, the natural slope of the land toward the Missouri River, and culverts that drain surface water directly into the Missouri River (Ref. 18, p. 19, 20, 22, 32, & 38; Ref. 23, p. 31). The surface water pathway from PPE#6 would continue past the sample collection locations of the 2003 and 2009 EPA investigations, through Rainbow Dam and Morony Dam to the 15-mile target distance limit (TDL) (Ref. 50, 1 page).

No information was found regarding existing surface water intakes on the 15-mile downstream segment.

The stretch of the Missouri River between Black Eagle Dam and Rainbow Dam is an active fishery. Fishing was observed by the sampling team during the 2009 Expanded Site Inspection (Ref. 23, pp. 28 & 33). The Montana Department of Fish, Wildlife and Parks estimates that a population of 1,292 rainbow trout and 302 brown trout are found in the 1.5 mile stretch between Black Eagle Dam and Giant Springs State Park (Ref. 34, p. 1). The fish that are caught along this stretch of the river are eaten by the anglers and their families (Ref. 44, 1 page; Ref. 45, 1 page; and Ref. 46, 1 page).

Approximately 0.1 mile of HRS eligible wetland frontage has been identified in the Missouri River within the zone of actual contamination by the US Fish and Wildlife Service as part of the National Wetlands Inventory (Ref. 35, pp. 1-3).

Recreational use of the Missouri River downstream of Black Eagle Dam include Giant Springs State Park and its associated fish hatchery and a recreational walking and cycling path, the River's Edge Trail (Ref. 40, pp. 1-4; Ref. 41, p. 1).

4.1.2.1 Likelihood of Release

4.1.2.1.1 Observed Release

Direct Observation

The Boston and Montana smelter routinely dumped large quantities of granulated slag and tailings into the Missouri River (Ref. 6, p. 42; Ref. 15, p. 1). In 1907, the Boston and Montana Consolidated Copper and Silver Mining Company estimated that the facility could receive up to 4800 tons a day of ore and changing the disposal of slag to railcar would significantly increase rail traffic (Ref. 14, p. 1). The Montana Department of Environmental Quality (Montana DEQ) estimates that between 27,500,000 and 31,000,000 cubic yards of waste were dumped into the Missouri River between 1893 and 1915 until onsite containment was instituted in 1915. Montana DEQ also reports that it is possible that dumping of waste into the Missouri River continued at a reduced rate after 1915 until the facility closed in the 1970s (Ref. 16, p. 1). So much smelter waste was dumped into the Missouri River between 1893 and 1915 that the management and legal department of the Boston and Montana Company were concerned that the Federal Government would intervene and enjoin the deposition of tailings into the Missouri River by virtue of the constitutional provisions requiring the federal government to maintain navigable streams (Ref. 15, pp. 1 and 2). In 1884 Judge Lorenzo Sawyer of the United States Circuit Court in San Francisco had granted a perpetual injunction against hydraulic mining in California's American River on these very grounds (Ref. 6, p. 38).

Numerous complaints were filed by property owners and communities along the Missouri River downstream of the ACM Smelter and Refinery of water quality issues and slag and smelter waste clogging the Missouri River (Ref. 6, p. 42; Ref. 29, p. 8A). These complaints increased after the 1908 flood of the Missouri River inundated the community of Fort Benton, 40 miles downstream of the Boston and Montana Smelter with

smelter waste (Ref. 6, p. 38; Ref. 29, p. 8A). A company analysis of slime (very fine grained slag and tailings, which tended to float in the Missouri River) taken above Rainbow Falls Dam in 1914 indicated that the slime contained between .55 and 1.1 percent copper (Ref. 17, p. 1). The Boston and Montana Company sought to buy off disgruntled property owners and placate communities by providing alternate domestic water sources (Ref. 6, pp. 49-51).

Cindery slag material was also currently observed to be in the sediments of the Missouri River adjacent to the ACM Smelter and Refinery facility (Ref. 23, p. 57 and 202, Ref, 53 p. 1; Ref. 54, p. 1).

Chemical Analysis

Eight sediment samples from the Missouri River were collected by Tetra Tech EM, Inc for the EPA's Expanded Site Inspection in April 2003. These samples were collected from the north bank of the Missouri River and consisted of medium to medium fine grained tan particles (Ref. 54, 1 page). All samples were analyzed through the EPA CLP, RAS for TAL total metals. Soil samples for inorganic analysis were delivered to Sentinal Inc, of Huntsville, Alabama (Ref. 18, p. 3). The analytical data was validated by Tetra Tech, EM, Inc, of Chicago, IL on July 30, 2003 (Ref. 18, p. 56). The following table provides analytical data to document the observed release by chemical analysis with the background sample and the most downstream samples with results greater than three times background (Ref. 18, Table 5, pp. 49-50).

Analyses of sediment samples collected during the April 2003 sampling event indicate that concentrations of arsenic, cadmium, copper, lead, manganese, and zinc are significantly above background concentrations in the Missouri River for a distance of 2.39 miles downstream of the probable point of entry (PPE) at the Black Eagle Dam (Ref. 18, p. 39, Figure 3). According to the HRS, if an observed release can be established, a value of 550 is assigned for Likelihood of Release (Ref. 1, Section 4.1.2.1.1, p. 51609).

Seven release sediment samples were collected by START for the EPA Region 8 on July 14, 2009. All release samples were collected by boat from the north side of the Missouri River from beneath the water. A background sample (AGFSED1) was collected from the north bank of the Missouri River, downstream of the Montana Refining Company facility and upstream of the outfall North River Road 9th to 15th Street No. 3 (PPE#1) and the community of Black Eagle (Ref. 50, 1 page). The samples were analyzed by Compuchem Laboratory in Cary, North Carolina, for total Target Analyte List (TAL) metals analysis with a supporting Level 4 data package (Ref. 23, pp 6, 15, & 21). The data package was validated by a START chemist who determined that the background cadmium result was biased high as well as two downstream results (Ref. 23, pp. 77-198). The analytical data was revised in accordance with the EPA guidelines for using qualified data, which resulted in the high bias for the background sample being retained while the two downstream, analytical results were revised downward (Ref. 43, pp. 1-9, 18). The following table provides analytical data to document the observed release by chemical analysis.

Analyses of sediment samples collected during the July 2009 sampling event indicate that concentrations of lead are above background concentrations in the Missouri River for a distance of 2.39 miles downstream of the probable point of entry (PPE) at the Black Eagle Dam (Ref. 24, p. 28, Table 3; Ref. 50). According to the HRS, if an observed release can be established, a value of 550 is assigned for Likelihood of Release (Ref. 1, Section 4.1.2.1.1, p. 51609).

Sediment Samples Collected from the Missouri River adjacent and downstream of the ACM Smelter and Refinery, July 2009						
Sample ID	**Sample Location**	**Sample Date**	**Cadmium (Cd) mg/kg**	**Lead (Pb) mg/kg**	**CRQL/**	**References**
AGFSED1 0907118-01	Background Sample at 11th Street	07/14/09	0.36 J+	12.3	Cd :0.06 Pb: 0.21-	Ref. 2, p. BII-2, BII-8; Ref. 23, pp. 28, 30, 37, 40, 46, 69, 70, 85, 174-176, 177, 179, 182, 183, 190, 204.
AGFSED2 0907118-02	1.89 miles downstream of PPE No. 1	07/14/09	(11.7 J+) 8.3	168	Cd: 0.06 Pb: 0.21-	Ref. 2, p. BII-2, BII-8; Ref. 23, pp. 28, 30, 37, 40, 47, 69, 70, 85, 174-176., 177, 179, 182, 183, 191, 202.
AGFSED3 0907118-03	1.95 miles downstream of PPE No. 1	07/14/09	11.8	78.4	Cd: 0.06 Pb: 0.21	Ref. 2, p. BII-2, BII-8; Ref. 23, pp. 28, 31, 37, 40, 48, 69, 70, 85, 174-176, 177, 182, 192, 202.
AGFSED4 0907118-04	2.06 miles downstream of PPE No. 1	07/14/09	3.9	18.9	Cd: 0.06 Pb: 0.21	Ref. 2, p. BII-2, BII-8; Ref. 23, pp. 28, 31, 37, 40, 49, 69, 70, 85, 174-176, 177, 182, 193, 202.
AGFSED5 0907118-05	2.39 miles downstream of PPE No. 1	07/14/09	(4.2 J+) 2.9	49.9	Cd: 0.06 Pb: 0.21	Ref. 2, p. BII-2, BII-8; Ref. 23, pp. 28, 32, 37, 40, 50, 69, 70, 85, 174-176, 177, 179, 182, 183, 194, 202-203.

Notes:
J+ The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample, but is biased high.
( ) Value prior to correction (Ref. 43, p. 13)
mg/kg milligrams per kilogram
CRQL Contract Required Quantitation Limit
SCDM Superfund Chemical Data Matrix

Attribution:

Residential soil contamination in the unincorporated residential community of Black Eagle located on the north bank of the Missouri River across from Great Falls, Montana, was first documented by the EPA's 2003 Expanded Site Inspection when elevated concentrations of antimony, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, silver, sodium, and zinc were found in one or more samples (Ref. 4, map 1; Ref. 18, pp. 28-30).

The 2007 EPA CERCLA Site Assessment sampled residences on both the north and south sides of the Missouri River adjacent to the Anaconda Minerals Co, Great Falls Refinery (Ref. 21, p. 11). Of the eleven residences sampled in Great Falls on the south side of the Missouri River in August of 2007 only one residence had an elevated concentration of arsenic (Ref. 21, p. 13). The results of the 2007 investigation of the residential soil in the community of Black Eagle identified an area of arsenic, cadmium, and lead concentrations greater than three times background centered on eastern and central Black Eagle (Ref. 21, p. 13-14, 18).

The 2008 EPA CERCLA Expanded Site Investigation was focused in the unincorporated community of Black Eagle, Montana. The residential soil at fifty nine residential properties in Black Eagle was sampled in July 2008 to a depth of one foot (Ref. 5, p. 1). Concentrations of arsenic, cadmium, and lead elevated three times background were detected in the residential soil in Black Eagle centered on the central and southwestern area of Black Eagle (Ref. 5, p. 13; Ref. 22, pp. 1-2).

The East Ditch Dump and fourteen additional source areas on the ACM Smelter and Refinery property were identified and sampled in April of 2003 by Tetra Tech EM, Inc. for an EPA Expanded Site Inspection (Ref. 18, pp. 8, 18-22, 38). There is no record of maintained engineered run on and run off structures and the observations of the soil cover of the sources during the 2003 sampling event ranged from non-existent to 10 inches deep which makes the contaminants from these sources available for migration (Ref. 1, p. 51646, Section 5.01; Ref. 18, p. 22). The contaminates associated with one or more of these sources included antimony, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc (Ref. 18, pp. 19-20). Culverts have been identified that drain surface water from the ACM Smelter and Refinery property directly into the Missouri River (Ref. 18, pp. 28, 31,).

Sediment samples from the north bank of the Missouri River were collected by boat on July 14, 2009 (Ref. 23, p. 16). The samples were shipped to CompuChem in Cary, North Carolina on July 15, 2009 (Ref. 23, p. 41). The analytical results were validated by URS Operating Services on July 24, 2009 (Ref. 23, p. 177). The sediment sample material was a grey to brown fine to medium grain size river sand with small to medium sized grains of black and rust colored cindery material mixed with the sand (Ref. 23, p. 202). The grab samples of sediment were analyzed for metals by EPA CLP method SW846 (Ref. 23, p. 40). Cadmium and lead elevated three times background was detected for a total distance of 2.39 miles downstream of PPE #1 (Ref. 23, p. 23; Ref. 50).

The Boston and Montana smelter routinely dumped large quantities of granulated slag and tailings into the Missouri River (Ref. 6, p. 42; Ref. 15, p. 1). In 1907, the Boston and Montana Consolidated Copper and Silver Mining Company estimated that the facility could receive up to 4800 tons a day of ore and changing the disposal of slag to railcar would significantly increase rail traffic (Ref. 14, p. 1). The Montana Department of Environmental Quality (Montana DEQ) estimates that between 27,500,000 and 31,000,000 cubic yards of waste were dumped into the Missouri River between 1893 and 1915 until onsite containment was instituted in 1915. Montana DEQ also reports that it is possible that dumping of waste into the Missouri River continued at a reduced rate after 1915 until the facility closed in the 1970s (Ref. 16, p. 1). So much smelter waste was dumped into the Missouri River between 1893 and 1915 that the management and legal department of the Boston and Montana Company were concerned that the Federal Government would

intervene and enjoin the deposition of tailings into the Missouri River by virtue of the constitutional provisions requiring the federal government to maintain navigable streams (Ref. 15, pp. 1 and 2). In 1884 Judge Lorenzo Sawyer of the United States Circuit Court in San Francisco had granted a perpetual injunction against hydraulic mining in California's American River on these very grounds (Ref. 6, p. 38).

Numerous complaints were filed by property owners and communities along the Missouri River downstream of the ACM Smelter and Refinery of water quality issues and slag and smelter waste clogging the Missouri River (Ref. 6, p. 42; Ref. 29, p. 8A). These complaints increased after the 1908 flood of the Missouri River inundated the community of Fort Benton, 40 miles downstream of the Boston and Montana Smelter with smelter waste (Ref. 6, p. 38; Ref. 29, p. 8A). A company analysis of slime (very fine grained slag and tailings, which tended to float in the Missouri River) taken above Rainbow Falls Dam in 1914 indicated that the slime contained between .55 and 1.1 percent copper (Ref. 17, p. 1). The Boston and Montana Company sought to buy off disgruntled property owners and placate communities by providing alternate domestic water sources (Ref. 6, pp. 49-51).

Cindery slag material was also currently observed to be in the sediments of the Missouri River adjacent to the ACM Smelter and Refinery facility (Ref. 23, p. 57 and 202, Ref, 53 p. 1; Ref. 54, p. 1).

The former Montana Silver Smelter site is located on the south bank of the Missouri River in Giant Springs State Park, approximately 2.85 miles east-northeast of the 15th Street Bridge (Ref. 4, 2 pages; Ref. 50, p. 1). The Montana Silver Smelter was constructed in 1888 by Great Falls city father, Paris Gibson (Ref. 56, p. 2). The smelter had two small stacks. Many of the structures at Giant Springs State Park and Giant Springs State Fish Hatchery were built on mineral processing wastes that contained extremely high levels of arsenic and lead. This property was cleaned up by the Montana Mine Waste Cleanup Bureau's Abandoned Mine Lands Program in 2004 (Ref. 57, pp. 9-11). The Montana Refining Company facility is located upstream of the unincorporated community of Black Eagle on the north bank of the Missouri River (Ref. 50, 1 map). The Montana Refining Company produces various grades of gasoline, diesel, jet fuel, distillates, and high grade asphalt products (Ref. 65, 1 page.). The facility has an operable capacity of 9,500 barrels per calendar day ranking the facility as number 132 of the 143 U.S. Refineries (Ref. 66, p. 4).

Both of the operations could potentially have contributed to the contamination documented in the Missouri River; however, the contamination found in the Missouri River sediments is at least partially attributable to the sources found on the ACM Smelter and Refinery property because of the evidence presented above.

4.1.2.1.2 Potential to Release

Potential to Release by overland flow was not evaluated because an observed release was established (Ref. 1 Section 4.1.2.1.2, p. 51609).

4.1.3.2 Human Food Chain Threat Waste Characteristics

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

Hazardous Substance	Source No.	Toxicity Factor Value	Persistence Factor Value*	Bioaccu-mulation Value**	Toxicity/ Persistence/ Bioaccumulation Factor Value (Table 4-16)	References
Arsenic	1 & 2	10,000	1.0	5.0	5×10^4	Ref. 2, p. BI-1
Cadmium	1 & 2	10,000	1.0	5,000	5×10^7	Ref. 2, p. BI-2
Lead	1 & 2	10,000	1.0	5.0	5×10^4	Ref. 2, p. BI-8
Manganese	2	10,000	1.0	50,000	5×10^8	Ref. 2, p. BI-8
Zinc	2	10	1.0	5.0	50	Ref. 2, p. BI-12

Notes: * Persistence value for Rivers
** Bioaccumulation factor value for Freshwater

The Toxicity/Persistence/Bioaccumulation Factor Value for manganese is 5×10^8 (Ref. 1, Section 4.1.3.2.1.4, Table 4-16; Ref. 2, p.BI-8).

Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8

4.1.3.2.2 Hazardous Waste Quantity

Source No.	Source Type	Source Hazardous Waste Quantity
1	Contaminated Soil	56.66
2	Landfill	> 0
Total		1

The source hazardous waste quantity value is assigned as the Hazardous Waste Quantity Factor Value (Ref. 1, Section 2.4.2.2). Although a Hazardous Waste Quantity Factor Value of 1 is assigned to a site whose sum of Source Hazardous Waste Quantity Values is greater than 1 but less than or equal to 100 (Ref. 1, Table 2-6, p. 51591), the presence of targets subject to Level II contamination and the fact that Tier A was not adequately determined means that the calculated value, or 100, whichever is greater, may be assigned (Ref. 1, Sec. 2.4.2.2, p. 51592).

Hazardous Waste Quantity Factor Value (100 >1)

Hazardous Waste Quantity Factor Value: 100
(Ref. 1, p. 51591, Table 2-6)

4.1.3.2.3 Waste Characteristics Factor Category Value

Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8
Hazardous Waste Quantity Factor Value: 100

Toxicity/Persistence x Hazardous Waste Quantity: 1×10^6
Toxicity/Persistence/Hazardous Waste Quantity x Bioaccumulation: 5×10^{10}

4.1.3.3 Human Food Chain Threat Targets

Actual Human Food Chain Contamination

Sample ID	Sample Medium	Distance from PPE	Hazardous Substance	Bio-accumulation Factor Value	References
AGFSED5 (0907118-5)	Missouri River Sediment	2.39 miles	Cadmium	5,000	Ref. 2, p. BI-8 Ref. 23, p. 23; Ref. 50

- Closed Fisheries:

The state of Montana has not declared any portion of the surface water pathway a closed fishery.

- Fish Tissue:

Fish tissue samples were collected by ARCO's contractor Paramatrix in 2004. Paramatrix concluded that the concentrations in tissue were largely comparable between upstream (background) and downstream (site) areas. A statistical analysis of the analytical data was not performed (Ref. 19, p. 3). A review of the report by the EPA's Regional Ecological toxicologist noted that at three sample locations ecotoxicological benchmarks were exceeded in soil samples, and it is likely that higher concentrations of metals in all samples could have been obtained by taking samples on the north side of the Missouri River, which is the same side as the facility rather than across from the facility on the south bank of the Missouri River (Ref. 20, p. 1, 2).

Level I Fisheries

The Missouri River is not documented as having fisheries subject to Level I actual contamination (Ref. 1, p. 51620).

Most Distant Level II Sample

The most distant Level II observed release sediment sample, 2.39 miles downstream of PPE #1 (Ref .23, p. 28, Ref. 50, 1 page).

Level II Fisheries

Identity of Fishery	Extent of Level II Fishery (Relative to PPE)	Refs.
Missouri River	2.39 miles	Ref. 23, p. 28; Ref. 34, p. 2; Ref. 50, 1 page; Ref. 44, Ref. 45; Ref. 46.

4.1.3.3.1 Food Chain Individual

Actual contamination of the Missouri River fishery was documented by Level II concentrations in sediment sample AGFSED5 (0907118-05). The stretch of the Missouri River between Black Eagle Dam and Rainbow Dam is an active fishery. Fishing was observed and photo documented by the sampling team during the 2009 Expanded Site Inspection at the Rainbow Boat Ramp. Photo documentation of fishing and a statement attesting to the consumption of fish caught in that reach of the Missouri River at the Rainbow Boat Ramp is documented (Ref. 23, pp. 27, 28, 33; Ref. 44, 1 page; Ref. 45; Ref. 46, 1 page). The Montana Department of Fish, Wildlife and Parks estimates that a population of 1,292 rainbow trout and 302 brown trout are found in the 1.5 mile stretch between Black Eagle Dam and Giant Springs State Park (Ref. 34, p. 1). The fish that are caught along this stretch of the river are eaten by the anglers and their families (Ref. 44, 1 page; Ref. 46, 1 page). This fishery is subject to Level II concentrations, due to a release of a contaminant with a BCF of greater than or equal to 500; a value of 45 is assigned to the Human Food Chain Individual Factor Value (Ref. 1, Sec. 4.1.3.3.1 and Sec. 4.1.3.3).

Food Chain Individual Factor Value: 45

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

Not applicable

Level I Concentrations Factor Value: 0

4.1.3.3.2.2 Level II Concentrations

The extent of the Level II contamination of the Missouri River fishery is 2.39 miles (distance from the most upstream PPE (PPE #1) in Missouri River at 11th Street in Black Eagle, Montana to Sample AGFSED05 (Ref. 23, p. 28; Ref. 50). Exact productivity values for the Missouri River fishery are not available. Therefore, to be conservative, a value of >0 but, unknown will be used for production values in the Missouri River. For an annual production of greater than 0 to 100 pounds per year, a Human Food Chain Population Value of 0.03 is assigned as the Level II concentrations factor value (Ref. 1, Section 4.1.3.3.2.2, p. 51621, Table 4-18).

Identity of Fishery	Annual Production (pounds)	References	Human Food Chain Population Value (Table 4-18)
Missouri River	>0.0 lb./acre	Ref. 1, Sec 4.1.3.3.2.2, p. 51621	0.03

Sum of Level II Human Food Chain Population Values: 0.03

Level II Concentrations Factor Value: 0.03

4.1.3.3.2.3 Potential Human Food Chain Contamination

The Missouri River downstream of sample location AGFSED05 to the 15-mile TDL may be considered a fishery subject to potential contamination. Sediment samples have not been collected below Rainbow Dam to the 15-mile TDL. Values for the amount of human food chain organisms produced annually from these fisheries have not been estimated, but are evaluated a greater than 0 pounds per acre.

Identity of Fishery	Annual Production (pounds)	Type of Surface Water Body	Average Annual Flow (cfs)	Ref.	Population Value (P_i) (Table 4-18)	Dilution Weight (D_i) (Table 4-13)	$P_i \times D_i$
Missouri River	>0	large stream to river	6733 cfs	Ref. 1, p. 51613, 51621 Ref. 13, p. 3	0.03	0.001	0.00003

Sum of $P_i \times D_i$: 0.00003
(Sum of $P_i \times D_i$)/10: 0.000003
Potential Human Food Chain Contamination Factor Value: 0.000003

Potential Human Food Chain contamination value: 0.000003

4.1.3.3.2.4 Calculation of Population Factor Value

The population factor value is calculated by summing the value of Level I concentration (0), Level II concentration (0.03) and potential human food chain contamination factors (0.000003). The resulting value is assigned the population factor value for the watershed (Ref. 1, p. 51621, Section 4.1.3.3.2.4).

Calculations: (0) + (0.03) + (0.000003) = 0.030003

4.1.3.3.3 Calculation of a Human Food Chain Threat - Target Factor Category Value

The Human Food Chain Threat-Target Factor Category Value is calculated by summing the Food Chain Individual (45) and Population Factor Value of the watershed (0.030003). The resulting value, 45.030003, is assigned as the Human Food Chain Threat-Target Score (Ref. 1, p. 51620, Sec. 4.1.3.3.2).

Food Chain Target Factor Category Value: 45.030003

4.1.3.4 Calculation of a Human Food Chain Threat Score for a Watershed

The Human Food Chain Threat is calculated by multiplying the Human Food Chain Threat Factor Category Value for likelihood of release (550), Waste Characteristics (320) and Targets for a Watershed (45.030003). The product is rounded to the nearest integer and divided by 82,500. The resulting value, subject to a maximum of 100, is assigned as the Human Food Chain Threat Score for the watershed (Ref. 1, p. 51621, Sec. 4.1.3.4).

Calculations: (Likelihood of Release 550)(Waste Characteristics Value 320)(Targets 45.030003) = 7,925,280.5

7,925,280.5/82,500 = 96.06

Human Food Chain Threat Score: 96.06

4.1.4.2 Environmental Threat Waste Characteristics

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

The Ecosystem Toxicity/Persistence/Bioaccumulation Values are based on the contaminants detected in the Source and the observed release.

Hazardous Substance	Source No.	Ecotoxicity** Factor Value	Persistence Factor Value*** (River)	Bioaccumulation Factor Value (Env./Fresh)	Ecotoxicity/ Persistence/ Bioaccumulation Factor Value	Ref.
Arsenic	1 & 2	10	1.0	5,000	5×10^4	Ref. 2, p. BI-1
Cadmium	1 & 2	10,000	1.0	50,000	5×10^8	Ref. 2, p. BI-2
Lead	1 &2	1,000	1.0	50,000	5×10^7	Ref. 2, p. BI-8
Manganese	2	0	1.0	50,000	0	
Zinc	2	10	1.0	50,000	5×10^5	Ref. 2, p. BI-12

** Ecotoxicity values assigned are based on the predominant surface water category of fresh water.
*** Persistence values assigned are based on the predominant surface water body category "River."

Cadmium has the highest Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value for this Watershed, 5×10^8 (Ref. 1, Table 4-21; Ref. 2, p.BI-2). Cadmium was selected to assign the value to this factor as directed by HRS Section 4.1.4.2.1.4 (Ref. 1, Section 4.1.4.2.1.4).

Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8

4.1.4.2.2 Hazardous Waste Quantity

The factor value derived for the drinking water threat or the human food chain threat hazardous waste quantity (100) is assigned to the environmental threat hazardous waste quantity factor value as directed by HRS Section 4.1.4.2.2 (Ref. 1, Section 4.1.4.2.2).

Hazardous Waste Quantity Value: 100

4.1.4.2.3. Waste Characteristics Factor Category Value

The waste characteristics factor category value is derived by first multiplying the ecotoxicity/persistence factor value and the hazardous waste quantity factor value for the watershed (subject to a maximum of 1×10^8). This product is then multiplied with the ecosystem bioaccumulation potential factor value for this hazardous substance as presented in Section 4.1.4.2.1 of this HRS documentation record (subject to a maximum value of 1×10^{12}) (Ref. 1, Section 4.1.4.2.3).

Ecosystem Toxicity / Persistence Factor Value = 10,000
Hazardous Waste Quantity Factor Value = 100
$10{,}000 \times 100 = 1 \times 10^6$

Ecosystem toxicity/persistence factor value
x hazardous waste quantity factor value: 1×10^6

Ecosystem Bioaccumulation Potential Factor Value = 50,000

(Ecosystem toxicity/persistence x hazardous waste quantity factor value)
x bioaccumulation potential factor value:
$(100 \times 10{,}000) \times (50{,}000) = 5 \times 10^{10}$
(Subject to a maximum of 1×10^{12})

The value calculated is 5×10^{10}. As directed by the HRS, this value is applied to HRS Table 2-7 to determine the Waste Characteristics Factor Category Value (Ref. 1, Sections 2.4.3.2 and 4.1.4.2.3, Table 2-7).

Hazardous Waste Quantity Factor Value: 100

Waste Characteristics Factor Category Value: 320

4.1.4.3 Environmental Threat - Targets

Wetlands along the banks of the Missouri River and on Black Eagle Island and Steamboat Island in the Missouri River are identified by the U.S. Fish and Wildlife Service as part of the National Wetlands Inventory (Ref. 35, pp 1-3). Most of the wetlands immediately below Black Eagle Dam are classified as Riverine Perennial wetlands, and Palustrine Emergent wetlands are identified further downstream of the Black Eagle Dam within the zone of documented contamination (Ref. 35, pp 1-3). Most of the wetlands identified on the U.S. Fish and Wildlife Service National Wetlands Inventory Map for Northeast and Northwest Great Falls Montana within the zone of actual contamination qualify as eligible wetlands defined in 40 CFR Sec 230.2 because most of these wetland types are likely to contain a prevalence of wetland plant species based on their classification such as the palustrine emergent wetlands mentioned above.

4.1.4.3.1 Sensitive Environments

4.1.4.3.1.1 Level I Concentrations

Level I concentrations have not been established in association with the site for sample location AGFSED5 (Ref. 23, p. 28).

4.1.4.3.1.2 Level II Concentrations

At least 0.1 mile of wetland frontage occurs within the zone of actual contamination and is subject to Level II contamination using sediment samples alone (Ref. 1, Table 4-24).

Level II Concentrations Factor Value: 25

4.1.4.3.1.3. Potential Contamination

Sensitive Environments

No sensitive environment targets were evaluated for their potential target values.

Potential Contamination Factor Value: NS

4.1.4.3.1.4 Environmental Threat-Targets Factor Category Value

The environmental threat target factor category value for the watershed is the sum of the values for the Level I (0), Level II (25) and potential contamination factors (0) (Ref. 1, Section 4.1.4.3.1.4).

Environmental Threat-Target Factor Category Value = 25

4.1.4.4 Environmental Threat Score for Watershed

The environmental threat score is calculated by multiplying the environmental threat factor category value for likelihood of release (550), the waste characteristics (320) and targets for a watershed (25). The product is rounded to the nearest integer and divided by 82,500. The resulting value, subject to a maximum of 60, is assigned as the Environmental Threat Score for the Watershed (Ref. 1, Section 4.1.4.4).

Calculation:

550 X 320 X 25 = 4,400,000

4,400,000/82,500 = (subject to a maximum of 60) = 53.33

Environmental Threat Score: 53.33

5.0 SOIL EXPOSURE PATHWAY

5.0.1 GENERAL CONSIDERATIONS

Letter by which this area is to be identified: A

Name of area: Contaminated residential soil in Black Eagle, Montana

Residential soil contamination in the community of Black Eagle was documented by the EPA's 2003, 2007, and 2008 investigations when elevated concentrations of arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, sodium, and zinc were found in one or more samples (Ref. 5, pp. 13-14; Ref. 18, pp. 28-30; Ref 21 pp. 10, 13-14).

The 2007 EPA CERCLA Site Assessment sampled residences on both the north and south sides of the Missouri River adjacent to the Anaconda Minerals Co, Great Falls Refinery (Ref. 21, p. 11). Of the eleven residences sampled in Great Falls on the south side of the Missouri River in August of 2007 only one residence had a elevated concentration of arsenic (Ref. 21, p. 13). Thirty-three residences were sampled for CLP analysis north of the Missouri River in Black Eagle in August of 2007, and arsenic and lead concentrations greater than three times background were identified in central and eastern Black Eagle from the results of the 2007 investigation (Ref. 21, pp. 13-14, 18). All soil samples collected were analyzed in the field using a portable XRF device (Ref. 5, p. 12; Ref. 21., p. 12). All samples for fixed laboratory analyses were analyzed through the EPA's CLP, RAS. The samples collected in 2007 were analyzed by A4 Scientific, Inc. of The Woodlands, Texas by EPA CLP method ILM05.4 (Ref. 60, p. 1; Ref. 61., p. 1; Ref. 62, p. 1).

The 2008 EPA CERCLA Expanded Site Investigation was focused in the community of Black Eagle, Montana. The residential soil at fifty-nine residential properties in Black Eagle was sampled in July 2008 to a depth of one foot (Ref. 5, p. 1). Concentrations of arsenic, cadmium, lead and zinc elevated three times background were detected in the residential soil in Black Eagle (Ref. 5, pp. 13-14; Ref. 18, pp. 28-30; Ref. 21, pp. 13-14). Elevated arsenic and cadmium results delineated an area of contamination centered on southwestern and central Black Eagle (Ref. 5, pp. 13-14, 23-24).

All 2008 soil samples collected were analyzed in the field using a portable XRF device (Ref. 5, p. 12; Ref. 21., p. 12). All samples for fixed laboratory analyses were analyzed through the EPA's Contract Laboratory Program (CLP), Routine Analytical Services. The samples collected in 2008 were analyzed by Chemtech Consulting Group, Mountainside, New Jersey by EPA CLP method ILM05.4 (Ref. 63. p. 1; Ref. 64, p. 1).

Areas of contamination in which all residences are subject to actual contamination, were calculated using Global Positioning System (GPS) coordinates of sample locations with 2007 and 2008 arsenic and cadmium analytical results that were greater than three times background and above a health based benchmark (i.e., samples with Level I concentrations). The area was processed with GIS software (Ref. 22, p. 1; Ref. 24, p. 1).

Background Concentrations:

A total of four background soil samples were collected in 2007 and 2008. Two background soil samples were collected in 2007 and two more background soil samples were collected in 2008. All four background samples were collected in populated areas west of the community of Black Eagle and on the north side of the Missouri River from sandy-silty soils formed on the Kootenai Formation (Ref. 5, p. 5, 10; Ref. 21, p. 4, 11; Ref. 10, 1 sheet; Ref. 36, book 2, p. 3 & book 3, pp. 17-18; Ref. 52, pp. 15-16, 28; Ref. 49, 1 page). The background samples for both 2007 and 2008 were collected in the same manner as all the soil samples. Stainless steel hand augers, bowls, and spoons were used for soil collection. Grab soil samples were collected from two horizons; zero to 2 inches and 6 to 12 inches bgs. The non-disposable sampling equipment was

decontaminated between sample locations. The samples were collected into a stainless steel bowl before being transferred into a 12X12 inch seal top poly bag or directly into 12X12-inch seal top poly bags labeled with the sample identifier. Sample descriptions were logged on the field form with standard geologic descriptions along with a sketch map with dimensions of the property, description of the zone sampled, and any calculations supporting the decision. A photograph for report documentation was taken of each sample location showing the residence in the background of the photograph (Ref. 5, p. 11; Ref. 21, p. 11-12).

The highest value between the four background samples is used as the background value for this document (Ref. 48). Background sample R04ST2400F112 was collected on August 10, 2007 from Jaycee Park approximately 5,900 feet west of U.S. Highway 87 (Ref. 49, p. 1). The arsenic background of 17.2 mg/kg and the manganese background of 374 mg/kg were taken from this background sample location. Background sample R08ST2601F112 was collected on August 8, 2007 from the property of North Middle School approximately 3,000 feet west of U.S. Highway 87 (Ref. 21, p. 26; Ref. 49, p. 1). The cadmium background of 0.67 mg/kg was taken from this background sample location. Background sample R25AV0724FY02 was collected on July 11, 2008 from the front yard of the residence at 724 25th Street, approximately 3,400 feet west of U.S. Highway 87 (Ref. 36, logbook # 2, p. 3; Ref. 5, p. 10; Ref. 49, p. 1). The lead background value of 25.3 mg/kg and the background value for zinc of 108 mg/kg were taken from this background sample location. The fourth background sample location was collected on July 11, 2008 from the side yard of the residence at 737 25th Avenue, approximately 3,500 feet west of U.S. Highway 87 (Ref. 36, logbook # 2, p. 3; Ref. 5, p. 10; Ref. 49, p. 1).

The background values for arsenic, cadmium, and lead used to calculate elevated concentrations are included in the following table in bold:

***ACM Smelter and Refinery – Background Samples 0-2 inch horizon collected in 2007 and 2008 (mg/kg)**

Analyte	CRDL/ MDL(2007/2008)	SCDM Benchmark RDSC	Jaycee Park R04ST2400F102 CLP - MHIH26 Sampled 8/10/2007	North Middle School R08ST2601F102 CLP - MH1H34 Sampled 8/8/2007	724 25th Ave. R25AV0724FY02 CLP - MH26P6 Sampled 7/11/2008	737 25th Ave. R25AV0737SY02 CLP - MH26P7 Sampled 7/11/2008
Arsenic	1/(0.49/0.37)	0.43	13.3	(10.4 J) **18.1**	6.3	16.1
Cadmium	0.5/(0.20/0.040)	39	**1.2 J+**	0.82 J+	0.53	(0.34 J) 0.48
Lead	1/(0.49/0.25)	-	**30.1**	(17.5 J) 25.2	25.3	20.6
Reference	Ref. 64, p. 51; Ref. 60, p. 64; Ref. 61, p. 64.	Ref. 2, pp. BII-13, BII-14, BII-20	Ref. 21, p. 29; Ref. 51, pp. 117, 120, 124, 138; Ref. 52. p. 28; Ref. 60, pp. 1, 3, 6, 8, 18, 78, 363-365, 594, 599, 604;	Ref. 21, p. 29; Ref. 51, pp. 2, 5, 9, 16; Ref. 52, pp. 15-16; Ref. 61, pp. 1, 3, 8, 9, 13, 219-221, 560, 566, 570,	Ref. 5, pp. 28-31, Appendix C, p. 55. Ref. 24, p. 2, Ref. 27, pp. 2, 3B, 3C, 3F, 3G, 3H, 9; Ref. 36, book 2, p. 3 & book 3, pp. 17-18; Ref. 64. pp. 1, 4, 7, 9, 15, 79.	Ref. 5, p. 28, & Appendix C, p. 55. Ref. 24, p. 2. Ref. 27, pp. 2, 3B, 3C, 3G, 3H, 10; Ref. 36, Book 2, p. 3, Book 3, pp. 17-18; Ref 64, pp. 1, 4, 7, 9, 16, 80.

* Sample IDs ending in 02 represent samples collected from 0-2 inches (Ref. 5, p. 10; Ref. 21, p. 11).
Bold Indicates background value selected for this document / mg/kg
CRSC Cancer Risk Screening Concentration
RDSC Reference Dose Screening Concentration
J The associated numerical value is an estimated quantity and is the approximate concentration of the analyte in the sample.
J+ The associated numerical value is an estimated quantity, but the result may be biased high.
( ) Validated value prior to adjustment as per EPA Fact Sheet "Using Qualified Data to Document an Observed Release and Observed Contamination" (Ref. 43, 18 pages).
mg/kg milligrams per kilogram

****ACM Smelter and Refinery – Background Samples 6-12 inch horizon collected in 2007 (mg/kg)**

Analyte	CRDL/ MDL(2007)	SCDM Benchmark RDSC	Jaycee Park R04ST2400F112 CLP - MHIH27 Sampled 8/10/2007	North Middle School R08ST2601F112 CLP - MH1H35 Sampled 8/8/2007	724 25th Ave. 6-12 inch sample not collected in 2008	737 25th Ave. 6-12 inch sample not collected in 2008
Arsenic	1/0.49	0.43	17.2	(13.3 J) **23.1**	-	-
Cadmium	0.5/0.20	39	0.43 J+	**0.67 J+**	-	-
Lead	1/0.49	-	10.6	(12.9 J)**18.6**	-	-
Reference	Ref. 60, p. 64; Ref. 61, p. 64	Ref. 2, pp. BII-13, BII-14, BII-20	Ref. 21, pp. 29-32; Ref. 51, pp. 117, 120, 124, 139; Ref. 52. p. 28; Ref. 60, pp. 1, 3, 5, 6, 8, 19, 117, 120, 124, 139, 366-368.	Ref. 21, pp.29-32; Ref. 51, pp. 2, 5, 9, 17; Ref. 52, pp. 15-16; Ref. 61, pp. 1, 3, 5, 8, 9, 14, 222-224	-	-

** Sample IDs ending in 12 represent samples collected from 6-12 inches (Ref. 5, p. 10; Ref. 21, p. 11).
Bold Indicates background value selected for this document / mg/kg
CRSC Cancer Risk Screening Concentration
RDSC Reference Dose Screening Concentration

J	The associated numerical value is an estimated quantity and is the approximate concentration of the analyte in the sample.
J+	The associated numerical value is an estimated quantity, but the result may be biased high.
( )	Validated value prior to adjustment as per EPA Fact Sheet "Using Qualified Data to Document an Observed Release and Observed Contamination" (Ref. 43, 18 pages).
mg/kg	milligrams per kilogram

Area of Observed Contamination

Surface Soil, <2 ft. bgs, all samples listed below show at least one concentration of arsenic, cadmium, or lead greater than 3 times background (Ref. 1, Table 2-3, p. 51589). All of the residential soil samples listed in the table were collected as grab samples from either the 0 to 2 "or the 6 to 12" horizon below ground surface using stainless steel hand augers, bowls, and spoons to collect the sample. All non-disposable sampling equipment was decontaminated between sample locations. The samples were collected into a stainless steel bowl before being transferred into a 12X12 inch seal top poly bag or directly into 12X12-inch seal top poly bags labeled with the sample identifier. All samples were collected within 200 feet of the residence on the property (Ref. 5, p. 11; Ref. 21, p. 11-12). Qualified analytical data has been corrected as per the EPA Guidance "Using Qualified Data to Document an Observed Release and Observed Contamination" (Ref. 43, pp. 4 and 13).

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
R11ST0111FY02 MH26N3	111 11th Street	07/11/2008	73.2	3	261	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5. Appendix C, p. 54. Appendix D, p. 1; Ref. 24, p. 1; Ref. 36, book 1, p. 5; Ref. 27, pp. 24, 27, 31, 32, 39; Ref. 63, pp. 1, 4, 7, 7A, 13, 62, 283.
R12ST0106FY12 MH26N4	106 12th Street	07/11/2008	30.6	2.7	98.7	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5. Appendix C, p. 53. Appendix D, p.5; Ref. 24, p. 1; Ref. 27, pp. 24, 27, 31, 32, 40; Ref. 36, book 1, p. 4; Ref. 63, pp. 1, 4, 7, 7A, 14, 62, 283.
R12ST0121FY112 MH26N5	121 12th Street	07/11/2008	215	13	706	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 50-51. Appendix D, p.8; Ref. 24, p. 1; Ref. 27, pp. 24, 27, 31, 41; Ref. 36, book 3, p. 17; Ref. 63, p. 1, 4, 7, 7A, 15, 62, 283.
R13ST0112BY02 MH26N6	112 13th Street	07/10/2008	47.3	44.9	562	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 45-47. Appendix D, p.9; Ref. 24, p. 1; Ref. 27, pp. 24, 27, 31, 42; Ref. 36, book 3, p. 12; Ref. 63, pp. 1, 4, 7, 7A, 16, 62, 283.
R13ST0117FY02 MH26N7	117 13th Street	07/11/2008	21.4	69.1	439	As = 1/0.37/0.43 Cd = 0.50.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 7-8. Appendix D, p.10; Ref. 24, p. 1; ref. 27, pp. 24, 27, 31, 32, 43; Ref. 36, book 1, p. 6-7; Ref. 63, pp. 1, 4, 7, 7A, 17, 62, 143, 283.
R13ST0121F112 MH1H38	121 13th Street	08/11/2007	(66.8 J) 38.4	(2.5 J+) 1.8	(754 J) 523.6	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 30, Appendix C, p. 4, Appendix D, p.2; Ref. 51, pp. 2, 5, 8,

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
							9, 10, 12, 20; Ref. 61, pp. 1, 3, 5, 8, 9, 17, 64, 288-290.
R13ST0123FY02 MH26N9	123 13th Street	07/12/2008	16.5	9.2	432	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 7. Appendix D, p.14; Ref. 24, p. 1; Ref 27, 24, 27, 31, 32, 45; Ref. 36, book 2, p. 5; Ref. 63, pp. 1, 4, 7, 7A, 19, 62, 148, 283
R13ST0127FY12 MH26P0	127 13th Street	07/12/2008	36.3	7.8	340	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 8. Appendix D, p.15; Ref. 24, p. 1; Ref. 27, 24, 27, 31, 32, 46; Ref. 36, book 2, p. 8; Ref. 63, pp. 1, 4, 7, 7A, 20, 62, 149, 283.
R14ST0122F102 MH1H39	122 14th Street	08/11/2007	(24.2 J) 13.9	111	(607 J) 421.5	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 29, Appendix C, p. 34, Appendix D, p. 3; Ref. 51, pp. 2, 5, 8, 10, 12, 21; Ref. 52, p 34; Ref. 61, pp. 1, 3, 5, 8, 9, 18, 291-293, 495-497
R16ST0121BY12 MH26P1	121 16th Street	07/14/2008	67.8	14.5	333	As = 1/0.37/0.43 Cd = 0.50.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 25. Appendix D, p.17; Ref. 24, p. 3; Ref. 27, pp. 2, 3B, 3G, 3H, 4; Ref. 36, book 2, p. 14; Ref. 61, pp. 1, 4, 7, 9, 10, 64, 74, 182, 184.
R15ST0215B102 MH1H40	215 15th Street	08/08/2007	(18 J) 10.3	11.6	(553 J) 384.0	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 29, Appendix C, p. 5, Appendix D, p. 4; Ref. 51, pp. 2, 5, 10, 12, 22; Ref. 61, pp. 1, 3, 5, 8, 9, 19, 64, 294-296
R15ST0307F112 MH1H41	307 15th Street	08/08/2007	(39.8 J) 22.9	(2.2 J +) 1.6	(789 J) 547.9	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 30, Appendix C, p. 5, Appendix D, p. 5; Ref. 51, pp. 2, 5, 8,

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
							9, 10, 12, 23; Ref. 61, pp. 1, 3, 5, 8, 9, 20, 64, 297-299, 381-383,
R16ST0128F112 MH1H43	128 16th Street	08/11/2007	(34.5 J) 19.8	(2.3 J+) 1.6	163	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 30, Appendix C, p. 6, Appendix D, p. 7; Ref. 51, pp. 46, 49, 52, 53, 54, 56, 60; Ref. 62, 1, 3, 8, 9, 13, 64, 112-114.
R17ST0122F112 MH1H44	122 17th Street	08/11/2007	(60.1 J) 34.5	(27 J) 19.2	967	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 30, Appendix C, p. 7, Appendix D, p. 8; Ref. 51, pp. 46, 49, 54, 56, 61; Ref. 62, pp. 1, 3, 8, 9, 14, 64, 115-117, 432-434.
R17ST0125F112 MH1H45	125 17th Street	08/12/2007	(43.5 J) 25	(6.9 J) 4.9	162	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 30, Appendix C, p. 7, Appendix D, p. 9; Ref. 51, pp. 46, 49, 54, 56, 62; Ref. 62, pp. 1, 3, 8, 9, 15, 64, 118-120.
R20ST0118BY12 MH26P3	118 20th Street	07/10/2008	22.8	9.4	319	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 47. Appendix D, p.22; Ref. 24, p. 2; Ref. 27, pp. 2, 3B, 3F, 3G, 3H, 6; Ref. 36, book 3, p. 14; Ref. 64, pp. 1, 4, 7, 9, 12, 51, 76, 180, 182
R21ST0328FY12 MH26P4	328 21st Street	07/15/2008	72.4	2.5	86.2	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 37. Appendix D, p.25; Ref. 24, p. 2; Ref. 27, 2, 3B, 3C, 3F, 3G, 3H, 7; Ref. 36, book 2, p. 18; Ref. 64, pp. 1, 4, 7, 9,13, 51, 77, 180, 182.
R21ST0520FY12 MH26P5	520 21st Street	07/15/2008	47.5	2.6	90.1	As = 1/0.37/0.43 Cd = 0.5/0.040/39	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 35. Appendix

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
						Pb = 1/0.25/NA	D, p.30; Ref. 24, p. 2; Ref. 27, pp. 2, 3B, 3C, 3F, 3G, 3H, 8; Ref. 36, book 2, p. 19; Ref. 64, p. 1, 4, 7, 9, 14, 51, 78, 92.
R21ST0625F112 MH1H47	625 21st Street	08/10/2007	43.6	2.7	124	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 30, Appendix C, p. 37, Appendix D, p. 13; Ref. 51, pp. 118, 120, 125, 126, 147; Ref 52, p. 26; Ref. 60, pp. 1, 3, 6, 10, 27, 64, 456-458.
R21ST0641S112 MH1H48	641 21st Street	08/10/2007	38.4	2.8	199	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 30, Appendix C, p. 9, Appendix D, p. 14; Ref. 51, pp. 118, 120, 125, 126, 148; Ref. 60, pp. 1, 3, 6, 10, 28, 64, 459-461.
R22ST0114B112 MH1H50	114 22nd Street	08/09/2007	84.4	27.3	397	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 31 , Appendix C, p. 10, Appendix D, p. 15; Ref. 51, pp. 118, 120, 125, 150; Ref. 60, pp. 2, 3, 6, 10, 30, 64, 465-467.
R22ST0118F102 MH1H52	118 22nd Street	08/09/2007	(22.4 J) 12.9	25.8	(519 J) 399.2	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 29, Appendix C, p.11, Appendix D, p. 16; Ref. 51, pp. 2, 5, 8, 10, 12, 26; Ref. 61, pp. 1, 3, 5, 8, 10, 23, 64, 315-317, 390-395
R22ST0613B112 MH1H54	613 22nd Street	08/10/2007	(39.8 J) 22.9	7.8	(272 J) 209.2	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 31, Appendix C, p. 38, Appendix D, p. 20; Ref. 51, pp. 2, 5, 8, 10, 12, 28; Ref. 52, p. 29; Ref. 61, pp. 1, 3, 5, 8, 11, 26, 64, 321-323, 420-422

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
R22ST0633B112 MH1H55	633 22nd Street	08/10/2007	(53.1 J) 33.2	2.9	(290 J) 223.1	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 31, Appendix C, p. 16, Appendix D, p. 22; Ref. 51, pp. 2, 5, 8, 10, 12, 29; Ref. 61, pp.1, 3, 5, 8, 11, 26, 64, 324-326, 423-425
R22ST0641B112 MH2174	641 22nd Street	08/09/2007	(88.8 J) 55.5	3.6	(223 J) 171.5	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 31, Appendix C, p. 17, Appendix D, p. 23; Ref. 51, pp. 3, 5, 8, 10, 12, 30; Ref. 61, pp. 1, 3, 5, 8, 11, 27, 64, 327-329, 426-428
RCHAV1820BY12 MH26Q0	1820 Chicago Ave.	07/13/2008	50.9	2.7	89.4	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, pp. 29, 65, Appendix C, pp. 23-24, Appendix D, p. 34, Ref. 27, pp. 2, 3B, 3C, 3F, 3G, 3H, 13; Ref. 64, pp. 1, 4, 7, 9, 19, 51, 85, 182, 185, 189.
RCOAV1508S112 MH2176	1508 Colorado Avenue	08/10/2007	(53.1 J) 33.2	(3 J+) 2.1	179	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 31, Appendix C, p.18, Appendix D, p. 26; Ref. 51, pp. 46, 49, 52, 53, 54, 56, 63; Ref. 62, pp. 1, 3, 8, 10, 16, 64, 121-123, 435-437
RCOAV1702BY12 MH26Q2	1702 Colorado Avenue	07/12/2008	29.3	1.6	76.7	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 11. Appendix D, p.37; Ref. 24, p. 4; Ref. 27, pp. 2, 3B, 3C, 3F, 3G, 3H, 15; Ref. 36, book 2, p. 5; Ref. 64, p. 1, 4, 7, 8, 21, 51, 87.
RCOAV1711B102 MH2177	1711 Colorado Avenue	08/10/2007	(23.9 J) 13.7	(3.9 J) 2.8	94.6	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 29, Appendix C, p. 20, Appendix D, p. 29; Ref. 51, pp. 46, 49, 52, 54, 56, 64; Ref. 62, pp. 1, 3,

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
							8, 10, 17, 64, 124-126.
RCOAV1903B112 MH2179	1903 Colorado Avenue	08/10/2007	(63.8 J) 39.9	(13.2 J) 9.4	866	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 31, Appendix C, p. 21, Appendix D, p. 31; Ref. 51, pp. 46, 49, 52, 54, 56, 65; Ref. 62, pp. 1, 3, 8, 10, 18, 64, 127-129, 438-440
RCOAV1904B112 MH2180	1904 Colorado Avenue	08/09/2007	(32.9 J) 18.9	(5.5 J) 3.9	224	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 31, Appendix C, p. 43, Appendix D, p. 32; Ref. 51, pp. 46, 49, 52, 54, 56, 66. Ref. 62, pp. 1, 3, 8, 10, 19, 64, 130-132, 441-443
RCOAV1906B112 MH2181	1906 Colorado Avenue	08/09/2007	(35.7 J) 20.5	(6.9 J) 4.9	216	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix C, p. 45, Appendix D, p. 33; Ref. 51, pp. 46, 49, 54, 56, 67; Ref. 52, pp. 22-23; Ref. 62, pp. 1, 3, 8, 11, 20, 64, 462-464
RCOAV1909BY02 MH26Q3	1909 Colorado Avenue	07/13/2008	29.3	13.1	394	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 14. Appendix D, p.39; Ref. 24, p. 3; Ref. 27, pp. 2, 3B, 3F, 3G, 3H, 16; Ref. 36, book 2, p. 7; Ref. 64 pp. 1, 4, 7, 8, 22, 51, 88.
RCOAV1917VG02 MH2182	1917 Colorado Avenue	08/09/2007	(6.8 J) 3.9	(3.8 J+) 2.7	119	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 21, p. 29, Appendix C, p. 22, Appendix D, p. 36; Ref. 51, pp. 46, 49, 52, 53, 54, 56, 68; Ref. 62, pp. 1, 3, 8, 11, 21, 64, 153-155, 559,
RCOAV1922B112 MH2183	1922 Colorado Avenue	08/09/2007	(27.6 J) 15.9	(1.8 J+) 1.3	68.7	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix C, p. 46, Appendix D, p. 37; Ref. 51, pp. 46, 49, 53, 69; Ref. 52, p. 20; Ref. 62, pp. 1, 3, 8, 11, 22, 64, 75, 156-158, 567,

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
							568, 573.
RCOAV1923F112 MH2184	1923 Colorado Avenue	08/11/2007	35.3	3.8	152	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix C, p. 47, Appendix D, p. 38; Ref. 51, pp. 46, 49, 52, 53, 54, 56, 70; Ref. 52, p. 31; Ref. 62, pp. 1, 3, 8, 11, 23, 64, 177-179, 560.
RCOAV1925F112 MH2185	1925 Colorado Avenue	08/12/2007	(29.3 J) 16.8	(2.6 J+) 1.8	141	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix C, p. 23, Appendix D, p. 39; Ref. 51, pp. 46, 49, 52, 53, 54, 56, 71; Ref. 62, pp.1, 3, 8, 11, 24, 64, 180-182.
RMTAV1518FY02 MH26Q5	1518 Montana Avenue	07/15/2008	16.3	24.6	334	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 68. Appendix D, p.41; Ref. 24, p. 3; Ref. 27, pp. 3, 3B, 3F, 3G, 3H, 18; Ref. 64, pp. 1, 4, 7, 8, 24, 51, 89, 104.
RMTAV1708VG12 MH26Q7	1708 Montana Avenue	07/14/2008	67.3	1.2	75.8	As = 1/0.37/0.43 Cd = 0.50.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 43-44, Appendix D, p. 44; Ref. 24, p. 4; Ref. 27, pp. 3, 3B, 3C, 3F, 3G, 3H, 20; 20; Ref. 36, bk. 3, p. 11; Ref. 64, pp. 1, 4, 7, 8, 26, 51, 100.
RMTAV1716BY12 MH26Q8	1716 Montana Avenue	07/09/2008	9	11	536	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 41. Appendix D, p.46; Ref. 24, p. 3; Ref. 27, pp. 3, 3B, 3F, 3G, 3H, 21; Ref. 36, book 3, p. 8; Ref. 64 p. 27, 51, 186, 189.
RMTAV1722FY02 MH26R0	1722 Montana Avenue	07/10/2008	30.3	3.8	147	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 43. Appendix D, p.48; Ref. 24, p. 3; Ref. 27, pp. 3,

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
							3B, 3C, 3F, 3H, 29; Ref. 64, pp. 1, 4, 7, 8, 29, 51, 103.182, 187.
RMTAV1901FY12 MH26R1	1901 Montana Avenue	07/10/2008	43.4	2.9	148	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix D, p.50; Ref. 24, p. 3; Ref. 27. pp. 24, 27, 31, 32, 21; Ref. 63, pp. 1, 4, 7B, 21, 51, 62, 124, 285, 290, 295.
RMTAV1908F112 MH2186	1908 Montana Avenue	08/09/2007	(50.4 J) 29	(2.8 J+) 2	119	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix C, p. 48, Appendix D, p. 40; Ref. 51, pp. 46, 49, 52, 53, 54, 56, 72; Ref. 52, p21; Ref. 62, pp. 1, 3, 8, 11, 25, 64, 183-185.
RMTAV1912F102 MH2187	1912 Montana Avenue	08/09/2007	(14.4 J) 8.3	(4.8 J) 3.4	331	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 29, Appendix C, p. 49, Appendix D, p. 41; Ref. 51, pp. 46, 49, 52, 54, 56,73; Ref. 52, pp. 21-22; Ref. 62, pp. 1, 3, 5, 11, 26, 64, 186-188.
RMTAV1915BY12 MH26R3	1915 Montana Avenue	07/13/2008	75	0.5	26.7	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5, Appendix C, p. 20, Appendix D, p. 52; Ref. 24, p. 5; Ref. 27, pp. 24, 27, 31, 32, 49; Ref. 36, bk. 2, p. 11; Ref. 63, pp. 1, 4, 7B, 23, 51, 62, 128.
RMTAV1924B112 MH2189	1924 Montana Avenue	08/10/2007	(55.5 J) 34.7	(3.6 J+) 2.6	112	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix C, p. 50, Appendix D, p. 42; Ref. 51, pp. 47, 49, 52, 53, 54, 56, 75; Ref. 52, pp. 25-26; Ref. 62, pp. 1, 3, 5, 11, 28, 192-194.

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
RRBDR2720F102 MH2190	2720 Rainbow Dam Road	08/11/2007	(71.9 J) 44.9	(4.2 J) 3	141	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 29, Appendix C, p. 51, Appendix D, p. 43; Ref. 51, pp47, 49, 52, 54, 56, 76; Ref. 62, pp.1, 3, 5, 11, 29, 64, 195-197.
RRVAV2118B112 MH2191	2118 River Avenue	08/10/2007	(85.2 J) 53.3	(4.7 J) 3.3	1,650	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix D, p. 44; Ref. 51, pp. 47, 49, 52, 54, 56, 77; Ref. 62, pp. 1, 3, 5, 12, 30, 64, 198-200, 465-467.
RSMAV1605B112 MH2192	1605 Smelter Avenue	08/11/2007	(45.1 J) 25.9	(3.2 J+) 2.3	137	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix D, p. 45; Ref. 51, pp. 47, 49, 52, 53, 54, 56, 78; Ref. 62, pp.1, 3, 5, 12, 31, 64, 201-203, 486-488.
RSMAV1624B112 MH2193	1624 Smelter Avenue	08/11/2007	(72.6 J) 45.4	(2.7 J+) 1.9	280	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 32, Appendix D, p. 46; Ref. 51, pp. 47, 49, 52, 53, 54, 56, 79.Ref. 62, pp. 1, 3, 5, 12, 32, 64, 213-215.
RSMAV1917FY12 MH26R5	1917 Smelter Avenue	07/14/2008	42.7	3.8	167	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5. Appendix C, p. 28-29. Appendix D, p.56; Ref. 24, p. 5; Ref. 27, pp. 24, 27, 31, 32, 51; Ref. 36, book 2, p. 15; Ref. 63, pp. 1, 4, 7, 7B, 25, 62, 135.
RSMAV2021SY12 MH26R6	2021 Smelter Avenue	07/14/2008	53.1	13.5	351	As = 1/0.37/0.43 Cd = 0.5/0.040/39 Pb = 1/0.25/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 5. Appendix C, p. 67. Appendix D, p.57; Ref. 24, p. 4; Ref. 27, pp. 24, 27, 31, 32, 52; Ref. 63, pp. 1, 4, 7, 7B, 26, 51, 136.

Sample ID	Address	Sample Date	Arsenic (As) (mg/kg)	Cadmium (Cd) (mg/kg)	Lead (Pb) (mg/kg)	CRDL/MDL/SCDM (mg/kg)	References
RSMAV2233F102 MH2194	2233 Smelter Avenue	08/12/2007	(15 J) 8.6	6.7	(131 J) 100.8	As = 1/0.49/0.43 Cd = 0.5/0.20/39 Pb = 1/0.49/NA	Ref. 2, pp. BII-13, BII-14, BII-20; Ref. 21, p. 29, Appendix C, p. 59, Appendix D, p. 49; Ref. 51, pp. 3, 5, 8, 10, 12, 33; Ref. 61, pp. 1, 3, 5, 8, 12, 30, 64, 354-356.

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

J+ The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample, but is biased high.

( ) Value prior to correction as per EPA guidance 9285-7-14FS "Using Qualified Data to Document an Observed Release and Observed Contamination" (Ref. 43, pp. 2 and 13).

Attribution

In August of 2007 residential soil samples from the 0-2 inches below ground surface and the 6-12 inch below ground surface horizons were collected by START from 33 residential properties in Black Eagle, Montana (Ref. 21, pp. 13-14, 18).

In July 2008, residential soil samples from the 0-2 inches below ground surface and the 6-12 inch below ground surface horizons were collected by START from 59 residential properties in Black Eagle, Montana. A minimum of four soil samples were collected from each residential property. An additional 20 soil samples were collected from the public playground and baseball fields located on the south side of Black Eagle, Montana (Ref. 5, p. 1, 10). All soil samples were analyzed in the field using an X-Ray Fluorescence Spectrometer (XRF) (Ref 5, p. 1). Thirty-nine soil samples were selected after reviewing the field XRF data and were submitted to a Contract Laboratory Program (CLP) laboratory for collaborative analysis. A total of 60 soil samples, from both Great Falls and Black Eagle, in 2007 and thirty-nine soil samples from Black Eagle in 2008 were sent for collaborative analysis by analytical method EPA CLP ILM05.4 (Ref. 5, p. 1; Ref. 21, p.1; Ref. 60, p. 1; Ref. 61, p. 1, Ref., 62, p. 1, Ref. 63, p. 1, Ref. 64, p. 1).

Aerial deposition of contaminants emanating from the smelter smoke stacks between 1893 and 1972 is the most likely mechanism of contaminant transport to the community of Black Eagle's residential soils (Ref. 8, p. 6A; Ref. 9, p. 15). The 506 foot tall Big Stack was designed to eject a volume of 1,575,000 cubic feet of air per minute at a velocity of 450 feet per minute, a sufficient volume and rate to entrain and remove from the smelter all the gases and dust generated during the smelting process (Ref. 9, p. 20).). An internal Anaconda Copper Company Memorandum from 1951 stated that approximately 15.04 pounds of arsenic passed out of the stack every 24 hours (Ref. 33, p. 1).

The wind direction in the Great Falls, Montana area is usually from the southwest, particularly in the months of October through March. Wind data collected at the Great Falls International Airport, approximately 5 miles southwest of the community of Black Eagle shows that during March, April, and May the winds can blow from the northwest or northeast more than twenty percent of the time and that in the summer months of June, July, and August wind direction over Black Eagle is from the northeast or east more than 20 percent of the time
(Ref. 30, pp. 2-13). A south facing aerial photo published by the Great Falls Tribune in 2002 shows smoke from the 506 foot tall stack wafting westward across the community of Black Eagle (Ref. 29, p. 8A).

The former Montana Silver Smelter site is located on the south bank of the Missouri River in Giant Springs State Park, approximately 2.85 miles east-northeast of the 15th Street Bridge (Ref. 4, 2 pages). The Montana Silver Smelter was constructed in 1888 by Great Falls city father, Paris Gibson (Ref. 56, p. 2). The smelter had two small stacks. Many of the structures at Giant Springs State Park and Giant Springs State Fish Hatchery were built on mineral processing wastes that contained extremely high levels of arsenic and lead. This property was cleaned up by the Montana Mine Waste Cleanup Bureau's Abandoned Mine Lands Program in 2004 (Ref. 57, pp. 9-11).

The Montana Refining Company is located immediately west of the unincorporated community of Black Eagle on the north bank of the Missouri River at 1900 10th Street, NE, Great Falls, Montana (Ref. 50). The Montana Refining Company produces various grades of gasoline, diesel, jet fuel, distillates, and high grade asphalt products (Ref. 65, 1 page.). The facility has an operable capacity of 9,500 barrels per calendar day ranking the facility as number 132 of the 143 U.S. Refineries (Ref. 66, p. 4).

The former Montana Silver Smelter and the Montana Refining Company may have contributed contamination to the community. However, as documented above, the ACM Smelter and Refinery facility also contributed contamination; therefore, the contamination in Black Eagle is at least partially attributable to ACM Smelter and Refinery.

Area of Contamination Hazardous Waste Quantity

- Hazardous Constituent Quantity:
  Are the data complete for Hazardous constituent quantity for this area? NO

  Hazardous Constituent Quantity Assigned Value: NA

- Hazardous Wastestream Quantity:
  Are the data complete for Hazardous Wastestream quantity for this area? NO

  Sum (pounds): NA
  Wastestream Quantity/5,000 (Ref. 1, Table 5-2): NA

  Hazardous Wastestream Quantity Assigned Value: NA

- Volume:
  Are the data complete for Hazardous volume for this area? NO

  Sum (yd^3/gal): NA
  Equation for Assigning Value (Ref. 1, Table 5-2): NA

  Volume Assigned Value: 0

- Area: A

Description

Arsenic and cadmium results from soil samples collected in the summers of 2007 and 2008 that are documented to be at Level I concentrations delineate an area of approximately 1,926,569 square feet (ft^2) (Ref. 1, Sections 2.5.1, 2.5.2, 5.1.3.1; Ref. 22, p. 2). The area covered by streets within the area was calculated to be 322,000 square feet (Ref. 25, p. 1). It was calculated that an average of 31 percent of each lot in Black Eagle, Montana is covered by a structure or pavement or 69 percent of the average property is open soil (Ref. 26, p. 3).

Calculation

$(1{,}926{,}569\ ft^2\ \text{of contaminated soil}) - (322{,}000\ ft^2\ \text{of pavement}) = 1{,}604{,}569\ ft$ $(1{,}604{,}569\ ft^2)(0.69\ \text{open soil}) = 1{,}107{,}152.61 ft^2$

Source Type	Units (ft^2)	References
Contaminated Surface Soils	1,107,152.61	Ref. 22, p. 2; Ref. 25, p. 1; Ref. 26, p. 3

By following the stated procedure outlined in Sections 2.4.2 and 5.1.2.2 and Table 5-2 of the HRS (Ref. 1, p. 51647, Table 5.2), the area value is assigned as follows: $1{,}107{,}152.61(ft^2)/34{,}000 = 32.5633$

Area Assigned Value: 32.5633

5.1 RESIDENT POPULATION THREAT

Observed contamination samples were selected from the Analytical Results Reports for the 2007 CERCLA Site Assessment and from the 2008 Expanded Site Investigation to establish laboratory verified concentrations of arsenic lead, and cadmium, as well as sample ID, street address, property owner, and the date each sample was collected (Ref. 21, pp. 29-32; Ref. 5, pp. 28-31). All samples listed in Section 5.0.1 of this HRS documentation record were collected within 200 feet of the residence (Ref. 21, p. 1; Ref. 5, pp. 4 and 5). Analysis of sample R12ST0121FY12 (MH26N5) collected on July 11, 2008, with an arsenic concentration of 215 mg/kg, a cadmium concentration of 13 mg/kg, and a lead concentration of 706 mg/kg in surface soils from a collection depth < 2 feet bgs documents the resident population threat (Ref. 5, Appendix C, p. 49. Appendix D, p.8; Ref. 24, p. 1; Ref. 36, book 3, p. 17; Ref. 63 p. 15)

5.1.1 LIKELIHOOD OF EXPOSURE

The presence of arsenic, cadmium, and lead contamination in concentrations meeting observed contamination requirements on residential property within 200 feet of the primary dwelling establishes a resident population threat for the site (Ref.1, Section 5.1, p. 51646). The location of each sample was noted on the property sketch of the Residential Soil Sampling Log, which documents that all samples were collected on the property and within 200 feet of the residence (Ref. 5, Appendix D; Ref. 21, Appendix D). In addition a digital download of a property plat was obtained from the Cascade County uniquely identifying each parcel of property (Ref. 37, p. 1).

Resident Population Threat Likelihood of Exposure Factor Category Value: 550

5.1.2 WASTE CHARACTERISTICS

5.1.2.1 Toxicity

Hazardous Substance	Toxicity Factor Value	Reference
Arsenic, Cadmium, and Lead	10,000	Ref. 2, pp. BI-1, BI-2, BI-8

Toxicity Factor Value: 10,000

5.1.2.2 Hazardous Waste Quantity

Because Level I contamination has been documented, but the hazardous constituent quantity is not adequately determined for the area of observed contamination the final assigned waste quantity factor value is 10 (see Section 5.0.1 of this HRS documentation record; Ref. 1, Section 2.4.2.2.p. 51592, Section 2.4.2.2).

Area Assigned Value: 1

Area Letter	Source Type	AOC Hazardous Waste Quantity
A	Contaminated Soil	32.5633

Equation for Assigning Value (Ref. 1, p. 51647, Table 5-2; p. 51591, Section 2.4.2.2)
Since $1 < 32.5633 < 100$ the hazardous waste quantity factor value assigned from Table 2-6 is 1. However, as the hazardous constituent quantity is not adequately determined, a value of 10 is assigned for this AOC as per HRS, Section 2.4.2.2 (Ref. 1, Section 2.4.2.2).

Hazardous Waste Quantity Factor Value: 10
(Ref. 1, Section 2.4.2.2)

5.1.2.3 Calculation of Waste Characteristics Factor Category Value

Toxicity Factor Value: 10,000
Hazardous Waste Quantity Factor Value: 10

Toxicity Factor Value x Hazardous Waste Quantity Factor Value: 100,000

Waste Characteristics Factor Category Value: 18
(Ref. 1, p. 51592, Table 2-7)

5.1.3 TARGETS

5.1.3.1 Resident Individual

Level of Contamination (Level I/Level II): Level I

There are 8 residential soil samples that exhibit Level I arsenic or cadmium contamination within the unincorporated community of Black Eagle, Montana (see Section 5.0.1 of this HRS documentation record). These samples delineate an area of observed soil contamination and document the presence of Level I soil contamination at each of the eight residences. All residences within the area of observed soil contamination are subject to actual contamination. These samples were all collected on the resident individual's property and within 200 linear feet of the residence; therefore a resident individual factor of 50 is assigned (Ref. 5, pp. 4 & 5). (Ref.1, Section 5.1.3.1, p. 51647; 8; Ref. 5, p.10, Appendix D, p. 8)

Resident Individual Factor Value: 50

5.1.3.2 Resident Population

5.1.3.2.1 Level I Concentrations

Area Letter	Sample ID	Number of Residences	County Multiplier	No. of Residents
A	See Section 5.0.1 of this HRS documentation record	8	2.41	19.28

Sum of individuals subject to Level I concentrations: 19.28
Sum of individuals subject to Level I concentrations x 10: 192.8

Analysis from residential surface soil samples collected from the community of Black Eagle indicate the presence of arsenic and/or cadmium at levels three times the background concentration or greater, and exceeding the applicable health based benchmark at 8 residences (Ref. 2, pp. BII-I and BII-2). U.S. Department of Commerce, Bureau of Census data (Ref. 28, p. 1) indicates that there is an average of 2.41 individuals per residence in Cascade County, Montana. Eight residences, with an average of 2.41 residents

per household, result in a total of 19.28 individuals subject to Level I arsenic or cadmium concentrations. Since these individuals are subject to Level I contamination, the appropriate factor value is determined by summing the individuals subject to Level I contamination and multiplying by 10 (Ref. 1, Section 5.1.3.2.1, p. 51647) yielding a total factor value of 192.8

Level I Concentrations Factor Value: 192.8

5.1.3.2.2 Level II Concentrations

Properties that are wholly or partially included within the zone defined by arsenic and cadmium contamination at Level I concentrations include approximately 178 residences that are within 200 feet of the zone of contamination (Ref. 22, p. 2; Ref. 37, p. 1). Eight of these residences have documented Level I contamination within 200 feet of the residence leaving approximately 170 residences exposed to Level II contamination (Ref. 22. page 2; Ref. 37, p. 1). 170 residences with a county average of 2.41 individuals per residence results in 409.7 people being exposed to Level II Concentrations (Ref. 28, p. 1)

Sum of individuals subject to Level II contaminations: 409.7

Level II Concentrations Factor Value: 409.7

5.1.3.3 Workers

Total workers were not scored (NS)

Workers Factor Value: NS

5.1.3.4 Resources

Resource Description: There is no commercial agriculture, silviculture, or commercial livestock production or grazing within the area of observed contamination.

Resources Factor Value: 0

5.1.3.5 Terrestrial Sensitive Environments

Sensitive Environment Description: There are no terrestrial sensitive environments identified within the area of observed contamination.

Terrestrial Sensitive Environments Factor Value: 0

5.2 NEARBY POPULATION THREAT

Nearby population threat was not scored

Nearby Population Threat Factor Value: NS